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Simplified Liquid Emulsion Radioautography*

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Introduction

THE term *radioautography* denotes a method of studying the distribution of radioisotopes which have become incorporated in an organism by observing the patterns created when the radiation from the isotope impinges upon a photographic film placed near the tissues. Radioautography is superior to the counting methods for some types of biomedical research with radioisotopes. For instance, accurate determinations of the sites of deposition of isotopes in organs and tissues (and in special cases in individual cells) can be made by means of radioautography. It is also possible to estimate the relative quantities of radioisotope in the various parts of a tissue. Occasionally, amounts of radioisotopes which will barely record on a counter will yield useful information by radioautography since the photographic film can integrate the radiation dose over a much longer time than is practical with Geiger-Mueller or scintillation counting. Furthermore, accurate counting of radioisotopes in tissues requires the destruction of the tissue either by ashing, dissolving in acid or alkali, or homogenizing. This is not necessary with radioautography where the tissue, or at least the histological slide, remains intact and may be correlated with the pattern of the radioautogram. Several variations of the techniques of radioautography have evolved—such as: placing a photographic film (with its backing) in apposition with an histologic slide, floating the film (free of its backing) onto the tissue, mounting the tissue directly on a cut film instead of a slide, painting the melted film emulsion over the tissue on a slide, as well as others, and combinations of those stated. Extensive discussions of the theory and techniques of radioautography will be found in the reviews of Gross *et al*[9] and Fitzgerald *et al*[7] as well as in Boyd's book[6]. Passalacqua's bibliography[14] covering the period 1924-1954 may also be of interest.

Of the several radioautographic techniques, the melted emulsion or "coated" method of Bélanger and LeBlond[2] best satisfies the theoretical requirements for close contact between photographic emulsion and tissue, and thinness of emulsion layer. Furthermore, it provides the best method of retaining the original spatial relationship between the tissue and the radiographic image, for the emulsion layer becomes an integral part of the slide and remains in constant relation to the tissue. This is of great value in microscopic examination. In the method suggested by Bélanger and LeBlond, the melted emulsion was painted over tissues

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Figure 1. Emulsion container; cover removed.

Figure 2. Exposure box showing slide carrying tray.

sealed with a thin film of celloidin. Subsequently, LeBlond, Percival and Gross[12] and Bélanger[3,4] modified the method to remove certain objectionable features.

In attempting to use the methods of Bélanger and LeBlond in this laboratory, it was found that painting the emulsion on with a brush in the dark was unnecessarily difficult. Since it was possible to obtain radioautographic emulsions in bulk,* it was determined that very satisfactory emulsion layers could be obtained by dipping the histological slides into a quantity of the emulsion in its fluid state. It was also found that pseudoradiographic effects could be prevented by spraying the slides with acrylic plastic[15] in less time than the usual celloidin coating requires. It is hoped that the simplified, convenient method set forth below will serve as a point of departure for others to modify for their own research needs.

Materials

The bulk emulsion is diluted in the dark with a solution of 0.05% *Duponol* "C" in distilled water. Two parts *Duponol* solution to one part emulsion is usually used. Diluted emulsions yield thinner layers than undiluted. The *Duponol* "C" is thought to aid the even distribution of the emulsion over the tissue and slide. The *Duponol* solution and emulsion are heated together to about 40 C so that they can mix thoroughly. The diluted emulsion is then stored at approximately 5 C in a tightly closed, lightproof, hard rubber container (Fig. 1) whose internal surfaces have been sprayed with acrylic plastic.**

After the slides have been coated with emulsion some sort of lightproof container is necessary. While many use small black plastic slide boxes, it has proved convenient to use a specially constructed large black plastic box with runners upon which are carried trays holding 10 horizontal slides each (Fig. 2). The box is provided with a lightproof, vaporproof cover. The bottom of the box is fitted with an open vessel containing a saturated solution of KNO_2.

The photographic processing solutions

*Bulk emulsions are available in the United States from Ansco and Eastman Kodak and in the United Kingdom from Ilford, Ltd. and Kodak Ltd. Many types of Eastman Kodak radiographic emulsion will be supplied in bulk upon request.

**The plastic aerosol spray used is Krylon (crystal clear, #1301) manufactured by Krylon Inc., Philadelphia, 46, Penn.

used are undiluted Kodak D19, SB5a stop bath, and acid fixer. The stock solutions are poured into staining dishes as required.

Method

The histological slides which are used are prepared by appropriate methods but with cover-glasses supplanted by spraying with the acrylic plastic aerosol[15]. At the completion of the histological processing, slides are removed from the final reagent and the glass around the tissue is dried. The slides are then air-dried to allow excess reagent to evaporate from the tissue. Care must be taken that the tissue does not dry for more than a minute since cytological detail is destroyed if the tissue becomes too dry. When it is judged that the tissue is just moist, the first plastic coat is applied. This is done in a fume hood with the slides level. The aerosol sprayer is held 8 to 12 inches above the slides, pointing downward at approximately 60° from the vertical and a continuous, uniform stroking motion is used. Adeptness at depositing a thin, uniform layer of plastic upon the slides is easily acquired with practice. The thinnest possible layer is the objective. Measurements of the thickness of the plastic layer on 25 slides averaged 7-8 microns. It is possible to spray ten to twelve slides at one time. If more are attempted, those slides which are removed from the reagent earliest become too dry. After the slides have been sprayed they are allowed to remain in the gentle air-stream in the fume hood until the plastic solvent has completely evaporated. Since the plastic layer is very thin, the solvent evaporates readily in ten to twenty minutes.

Meanwhile the container of diluted emulsion should be warmed in a water bath to about 40 C so that it is completely fluid by the time the slides are ready. With most of the radiographic emulsions the remaining steps through to the fixing of the emulsion must be carried out in complete darkness. The container is opened and the emulsion is gently stirred with a clean glass rod. Vigorous stirring will result in bubbles and possible mechanical exposure of some silver grains.

Each slide is grasped at the label end and dipped into the emulsion so that the tissue is immersed well below the surface. The slide is immediately withdrawn and allowed to drain vertically for a few seconds over a gauze pad and then the emulsion on the lower surface is wiped away with the same pad. Emulsion should not be allowed to drain back into the container. As each slide is cleaned it is placed level in one of the trays made to fit into the exposure box. When a tray is full it is returned to the exposure box. The slides must be kept level for the 10 to 15 minutes it takes for the emulsion to gel, and then it is simplest to keep the slides in their trays in the box until the exposure period is over. The emulsion layer obtained by this method and with the 2:1 dilution is 5-10 microns thick, when dry.

Exposure is allowed to continue as long as experience and judgment indicate. When starting a new experiment or a new batch of slides, it is best to make replicates and develop one or two of each group at intervals until the optimum exposure time is apparent. One can use the method of Wainwright, *et al*[16] to calculate exposure times but very large correction factors will be required.

The humidity of the exposure box is maintained at 47% by keeping an open vessel of a saturated solution of potassium nitrite in the bottom. If this is not done the emulsion tends to dry out and crack during periods of low humidity.

When the exposure time has elapsed the slides are processed in glass staining dishes. Since it is not necessary to keep the slides level once the emulsion has gelled, the slides are placed in glass staining trays with the short axis of the slides vertical. In this way up to ten slides can be processed at one time. The processing schedule is as follows:

1. Kodak D19 Developer... 1 minute
2. Kodak SB5a Stop Bath.. 15 seconds
3. Kodak Acid Fixer..... 1 minute
4. Tap Water Rinse..... 1 second

The slides are dipped quickly in and out of the rinse water. If they remain in the rinse for any appreciable length of time reticulation occurs. Lights may be used after the slides have been in the fixer for 30 seconds.

The temperature of the solutions is critical. Reticulation hardly ever occurs if the solutions are maintained at 18 C $\pm$ 1. At 20 C $\pm$ 1 reticulation frequently occurs. It is also helpful if all the solutions are at exactly the same temperature.

After rinsing, the slides are allowed to dry in a clean air-stream. When they are thoroughly dry, the slides are again coated with plastic, to seal and protect the emulsion. This plastic layer is applied in the same manner as the first but it should be thicker. When the solvent has evaporated completely from the second plastic coat, the radioautograms are ready for examination under the microscope.

Any desired magnification may be used. It should be remembered, however, that ordinary high-dry lenses are ground to compensate for the presence of cover-glasses. Since there are no cover-glasses on these autograms a blurred image results when using the high-dry. In order to avoid placing unnecessary cover-glasses on the slides, one can cement a cover-glass over the lens aperture. Of course there are available high-dry objectives which are adjustable for cover-glass thickness. If one were doing much radioautography such a lens would be useful. Very satisfactory examinations can also be performed under oil. The thin focal plane of the oil immersion lens causes optical separation of the layer of developed silver grains and the tissue layer. This makes it possible to study the tissue in as much detail as if the slide were an ordinary histological preparation and yet one can correlate the radiographic image with the tissue by simply turning the fine adjustment knob.

If oil immersion photomicrographs of the radioautogram are needed, double exposures can be made, or, if an indexing method were used, separate negatives could be made of the cellular and silver layers. The separate negatives could then be superimposed for printing.

In this laboratory this method has been successfully used to prepare radioautograms of tissues containing Sr^{89}, Au^{198} (Fig. 3) and I^{131} (Fig. 4).

Discussion

In preparing the tissue slides for radioautography the chemical state of the isotope being used in the study determines the methods used for fixation and staining. Many of the reagents used in fixation, embedding, and staining may mobilize the isotope under investigation, removing it partially or entirely or causing it to diffuse more or less uniformly through the tissue. Kaminski[11] discusses various methods used to retain the isotope in as near the original concentration and position in the tissue as possible. In setting up new work it is well to monitor the various reagents through which the tissues are processed. If it appears that significant amounts of isotope remain in the reagents the method should be

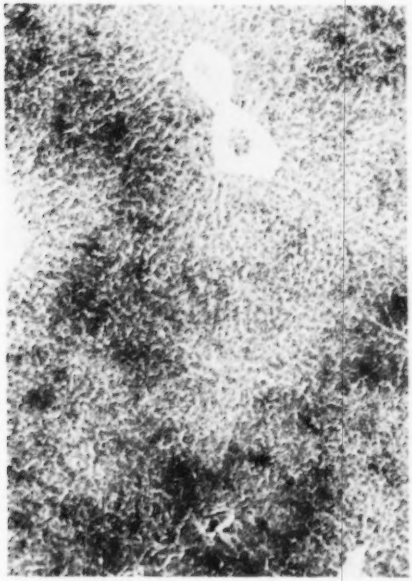

Figure 3. Photomicrograph of radioautogram. Rat liver. Sacrificed 3 days after intrapleural injection of 3.3 μc of Au^{198}. Eight day exposure. Heaviest reduction of silver occurred over and near smaller afferent vessels. 100X.

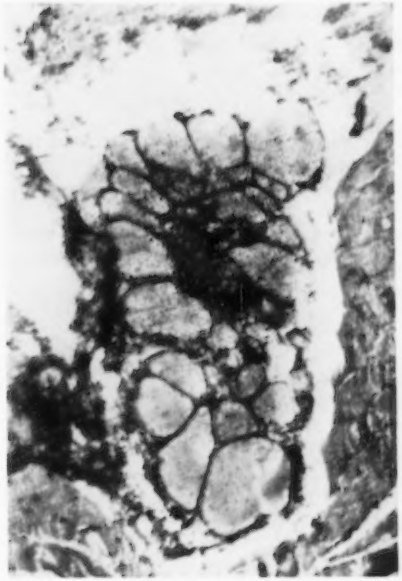

Figure 4. Photomicrograph of radioautogram. Hamster thyroid. Sacrificed 60 hours after intraperitoneal injection of 100 μc I^{131}. Three day exposure. Heaviest reduction of silver occurred over small central follicles. 100X.

changed. All manipulations of the tissue should be such that the isotope is retained in its original positions. Where appropriate, methods such as Bélanger's inversion technique[3] and the freeze-drying technique of Holt & Warren[10] or Arnold's acetone fixation[1] should be considered. For compounds which are soluble in organic solvents but not in aqueous solutions, embedding in carbowax[5] might be useful. It goes without saying that controls should always be used to prevent misinterpretation of artifacts.

The plastic spray method of protecting the emulsion layer from the tissue constituents and stains is excellent for routine use because of the speed and ease with which the layers can be applied. However 8 microns is rather too thick a layer for some purposes such as C^{14} radioautograms. If thinner protective layers are desired, the original celloidin technique is good, or one may turn to *Saran* or *Vinylite* coatings as suggested by Gomberg[8]. There is a discussion of thin protective films on page 285 of Boyd's book[6]. Occasionally, bubbles will be encountered in the acrylic plastic film. Bubbling may be minimized by allowing only the finest peripheral part of the spray to touch the slides, and by getting the thinnest possible layer. It has been found that a few bubbles can be easily tolerated in routine work. For special work one can turn to the other protective films.

Although it has never been a problem in this laboratory, Arnold[1] reports bubbling in the photographic emulsion layer. He recommends methods such as degass-

ing the photographic processing solutions for overcoming this problem. Perhaps the dip-coating method is superior to the brushing method here, too.

Thicker emulsion layers are desirable for alpha track studies. Levi[13] reports using 100 microns Ilford *G5* emulsion layers for this purpose. To obtain thick layers the emulsion should be diluted less or not at all. The temperature of the emulsion should be lowered to the point where it is just fluid. If still thicker layers are wanted the slides may be dipped more than once, allowing each layer to gel before applying the next. Conversely, if thinner layers are desired (for greater resolution) the emulsion may be made more dilute and the temperature raised even up to 50 C or higher.

The emulsion, in its container, may be used over and over again by storing it in the refrigerator at 5 C in the intervals between use. After six weeks to three months (depending on how much use the emulsion has been given) background fog begins to build up and the emulsion should be discarded. The fog is due to many factors: cosmic rays, naturally occurring radiation, irradiation during the immersion of the radioisotope bearing tissue, mechanical factors, the heating of the emulsion and probably others. From time to time a blank slide or two should be included in a run to check the fog level. There is always some unavoidable fog but one wants to know when the level begins to climb above the irreducible minimum. The fog level is also checked on each slide by examining an area of emulsion remote from the tissue.

Radioautograms prepared by the method outlined have remained in excellent condition for a year at this writing and there is no reason to suppose that they will not remain in good condition indefinitely.

Summary

A liquid emulsion radioautography method is described: simple and suitable for routine or special work. Method depends upon dipping stained histological slides (with an acrylic plastic film supplanting cover glass) into melted photographic emulsion.

Acknowledgements

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Wood and Fiber Structure By Incident Fluorescence Microscopy*

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Introduction

INCIDENT fluorescence microscopy provides a specialized means to study wood and fiber structure. Fluorescence is a characteristic of a material whereby absorption of invisible ultraviolet radiation excites emission of visible light that lasts only during the period of excitation. Although wood is autofluorescent, color contrasts and brighter images result after treatment with certain fluorescent dyes called fluorochromes.

References are numerous in the literature to the use of fluorescence in almost every microscopical field, but only a few describe its use in investigations of wood structure. Vodrazka[6], Wimmer[7], and Eichler[1] examined and photographed the fluorescence of some woods. Krishna and Chowdhury[2] inspected a large number of Indian timbers with filtered ultraviolet light and photographed some of these in color. Radley and Grant[5] have summarized literature on the fluorescence of woods.

Purpose

The work on improved microscopy of wood and fiber structure at the Forest Products Laboratory had the objective of simplifying observations and measurements, particularly of small specimens of wood from living trees, and of developing methods to observe wood structure in ways not obtainable by ordinary microscopy. Such methods have particular value in forest products research in providing a means to obtain reasonable evaluation of the intrinsic properties of the wood on the basis of structure. Applications also extend to the effects of silvicultural treatment on wood structure.

Equipment and Procedure

Essential for fluorescence microscopy and photomicrography of small opaque pieces of wood is a microscope designed particularly for surface illumination of the specimen. A stage is required that serves for coarse focusing of the specimen. An optical system is used that passes ultraviolet radiation to the specimen through quartz or ultraviolet transmitting glass. The light source used consists of a direct-current carbon arc lamp with a liquid filter of 10 per cent copper sulfate with a few drops of sulfuric acid added, together with a filter transmitting invisible ultraviolet radiation in the region from 3,000A-4,000A. Illumination of the object is by means of a quartz ring condenser with the circular path of the illuminating rays outside the optical path of the objectives. This arrangement pro-

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**Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

duces dark-field incident illumination of the specimen.

The fluorescent image when sufficiently bright can be viewed with binocular vision using 6×, 7×, or 10× paired oculars. Magnifications from 30 to 200 diameters are commonly used, but if desired, certain detailed features can be magnified up to as much as 500-750 diameters. In all cases the UV filter is in position at the eyepiece in order to absorb ultraviolet radiation reflecting from the object.

The laboratory equipment has been especially modified and constructed to allow observation, study, and photography with several types of illumination, i.e., ultraviolet, regular filament, ribbon filament, and zircon concentrated arc, individually or in combinations as desired. Apparatus can be selected and combined to permit the use of monocular or binocular vision, a protractor eyepiece, a revolving graduated mechanical stage with fine focusing adjustment, a revolving mechanical stage with coarse focusing adjustment, color photomicrography or black-and-white photomicrography, and color contrasts to surface illumination with transmitted light and selected color filters. Combinations of illumination often give improved visibility to structural details of fibers not easily distinguishable at high magnifications with visible light.

A procedure was published[3] for improved color contrast by use of Congo red. Photomicrographic records have been made, when desired, with black-and-white materials. Transparencies have been produced with daylight type 35mm color film, although long exposures are required because of the comparatively low intensity of the fluorescent light.

A method that has been developed and tested for several years for color differentiation of gelatinous fibers was discovered during a study of sections from hickory trees that are characterized by high internal stresses evidenced by splitting of the logs. This procedure has since been used for mahogany, oak, yellow-poplar, and tanoak. Details of the technique for treating sectioned material are as follows:

1. Treat transverse or longitudinal wood sections, 12-18 microns thick in an aqueous solution of Red BX*-1:1000, 2-3 minutes.

2. Rinse in ethyl alcohol series 50-70-95-100.

3. Transfer to clove oil until cleared.

4. Rinse in toluene.

5. Transfer to low viscosity low fluorescing oil.

6. Mount in high viscosity low fluorescing oil under a thin No. 0 or No. 1 cover glass.

Improved color contrast has been obtained with a combination of two fluorochromes. The procedure is as follows: Use a saturated solution of "brillant-dianilgrün" in 100 per cent alcohol 2-3 minutes after the 95 per cent alcohol, then rinse in 100 per cent alcohol and proceed with clove oil and the steps as outlined in the method above. Gelatinous layers of fibers show blue or blue green in contrast to red, pink, orange, yellow, or yellowish-green.

Treating times indicated are estimated values from which it may be desirable to deviate according to the thickness of the section and the nature of the material. Wood for sectioning was prepared by boiling in distilled water under reduced pressure until it sank. It was then sectioned by the steam method.

Rhodamine 6G† may be substituted for red BX in solutions of 1 part fluo-

*Aqueous solution of fluorochrome made up with distilled water in the ratio of 1 part fluorochrome to 1,000 parts water. *Calco Condensation Red BX*, lot 70099, furnished by American Cyanamid Company, Calco Dyestuff Department, Bound Brook, N. J.

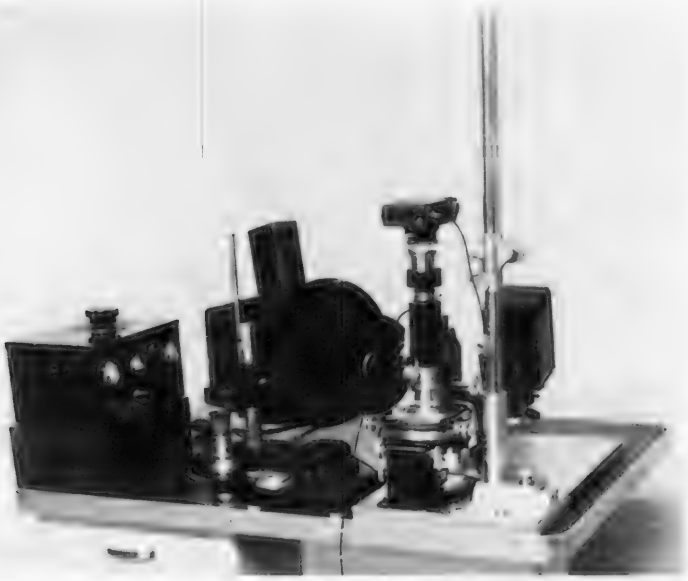

Figure 1. Equipment for incident fluorescence photomicrography with a 35mm camera. This arrangement is advantageous for combinations of illumination and for thin opaque preparations or for sections of material on slides.

rochrome to 1,000 parts of distilled water. Black-and-white and color photomicrographs have been made as desired.

A technique[4] using fluorescence microscopy has been developed for observing and measuring fibril angles in pine tracheids, particularly for increment cores or similar small samples from living trees. The procedure also lends itself to observing other structural features of wood and if desired, photographing of structure, all possible in the dry condition

Fluorescence microscopy has proved valuable for study of many dry preparations, such as enamel films on wood, glue joints of wood and plywood, paper surfaces, pulp and paper fibers, and the dispersion of resins in pulp mixtures. Condition of the surface of fibers is important at various stages of their preparation in paper making. Preliminary observations of surface features by incident illumination combined with transmitted light to reveal internal structure show promise of revealing valuable new information concerning structure of these fibers

The accompanying photomicrographs (Figure 3) demonstrate photography of wood structure by incidence fluorescence microscopy. Data concerning individual examples follow:

1. Transverse surface view of a block of longleaf pine wood showing summerwood tracheids and ray tissue, autofluorescence, block in distilled water, surface for examination covered with a thin cover glass, magnification 220×, UO 22× objective with quartz ring condenesr, 10X *Periplan* eyepiece.

[4]The following were found satisfactory: Rhodamine 6 G, C. I. No. 752, lot 12682, furnished by National Aniline Division, Allied Chemical & Dye Corporation, New York, N. Y.; Rhodamin 6 GD extra, K. Hollborn & Sohne, Leipzig; Rhodamine 6 GD (extra) [illegible], George T. Gurr Ltd, London S.W. 6., England; Calcozine Red 6 G extra, lot 630 furnished by American Cyanamid Company, Calco Dyestuff Department, Bound Brook, N. J

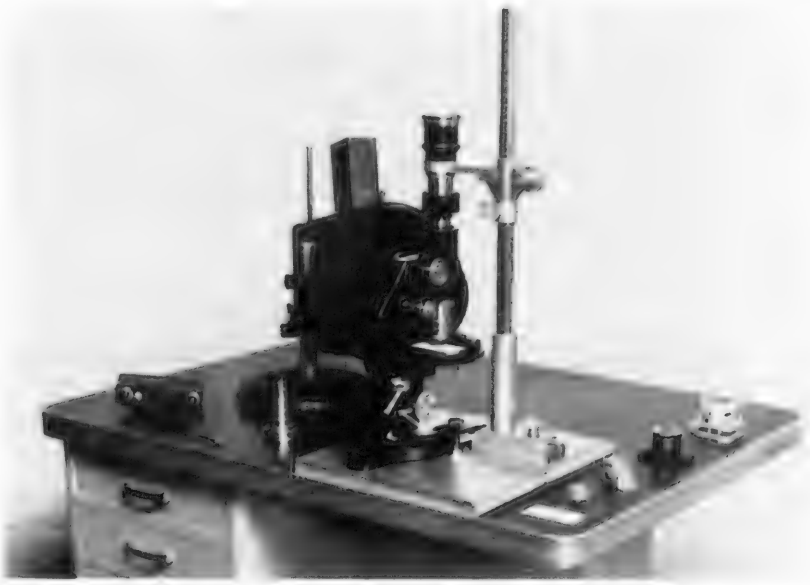

Figure 2. Apparatus for incident fluorescence photomicrography of preparations of various sizes with coarse focusing accomplished with the stage. Several types of preparations are illustrated along edge of table.

UV 2.5 filter, CC14 *Wratten* filter, 10 per cent copper sulfate liquid filter, *Corning* No. 9863 filter, carbon arc lamp, exposure 5 minutes on *Panatomic-X* film, developed in DK-20 at 68F for 20 minutes.

Transverse surface view of a block of longleaf pine wood showing twin resin ducts, summerwood tracheids, ray tissue and a false growth zone, stained in Congo red, preparation in distilled water, surface for examination covered with a thin cover glass, magnification 78X, UO 11X objective with quartz ring-condenser, Huyghens eyepiece 6XB, UV 2.5 filter, *Wratten* No. 28 filter, 10 per cent copper sulfate liquid filter, *Corning* No. 5840 filter, carbon arc lamp, exposure 15 minutes on *Panatomic-X* film, developed in DK-20 at 72F for 15 minutes.

3. Surface view of a dry white oak block showing growth zone with springwood vessels blocked with tyloses, magnification 30X, UO-5X objective with ring-condenser, Huyghens eyepiece 6XB, UV 2.5 filter, 10 per cent copper sulfate liquid filter, *Corning* No. 5840 filter, carbon arc lamp, exposure 15 minutes on *Panatomic-X* film, developed in DK-20 at 68F for 20 minutes.
4. Gelatinous fibers of California white oak, section 18 microns thick, cut by steam method, fluorochromed rhodamine 6 GD extra and "Brillantdiamingrün" G, mounted in high viscosity low fluorescing oil under a thin No. 0 cover glass, magnification 200 ×, UO-22× objective with quartz ring condenser, *Periplan* 10× eyepiece, UV 2.5 filter, 10 per cent copper sulfate liquid filter, *Corning* No.

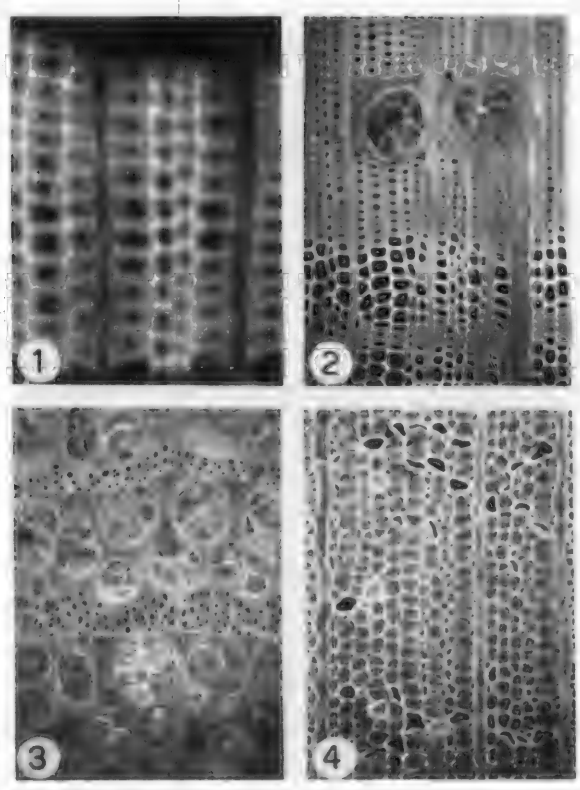

Figure 3. Photomicrographs of wood structure by incident fluorescence microscopy.

5840 filter, carbon arc lamp, exposure 1 minutes on *Panatomic* X film, developed in *Microdol* at 70F for 15 minutes.

Summary

Methods for fluorescence microscopy and photomicrography of woody tissues are described. Microscopical equipment was especially modified to permit its use with several types of illumination, individually or in combinations as desired. A technique was developed to give color contrast to gelatinous fibers. Examples of photomicrography show wood and fiber structure as observed by incident fluorescence microscopy.

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The Role of the Photographer In Medical Education*

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THE purpose of this paper is not to try to define the exact place or to list the responsibilities of photography in medical education but rather to discuss with you several aspects of your work which have become more and more important as time goes on and which seem to me to be particularly worthy of your attention.

Let me say at the start that the term "Medical Education" as it appears in the title is being used here in the broadest sense and it includes the related biological fields of Public Health, Dentistry, Pharmacy and Veterinary Medicine. Others would have been included but these happen to have made up my world for over 50 years and it is the only one I feel competent to talk about, although most of our problems and responsibilities are pretty much the same regardless of the particular area of education we are associated with.

We are all working in a world today that is hardly recognizable as the same one I entered as an untrained medical artist in 1904. In those days there was no such thing as a medical photographer in the sense that we know it now. The idea of an illustration department in a teaching institution would have been considered fantastic in those days. There was no such thing as a medical artist either although in both fields of illustration a few names were beginning to be known. One of these was Louis Schmidt of the Rockefeller Institute whom many of you will remember. He was not only an able artist as well as a pioneer scientific photographer but a person of fine character respected and loved by all who knew him. As one of the founders of the BPA it is fitting that we pay tribute to his memory on this occasion.

For some years following the turn of the century most of the illustrations of gross pathological specimens and microscopic fields were drawn by artists. It was painstaking hard work and whenever I smell formalin or see a photomicrograph being made today it takes me back to the long hours spent peering through a microscope or inhaling the fumes from a preserved specimen. Along about the time of the First World War, as I recall, photography was beginning to develop lenses, apparatus and skills and was taking over some of the specimen and microscopic illustration. By the time the Second World War came along the photographers were doing practically all of such work. Today it is rare that a medical artist is called upon to draw a gross specimen and still rarer to make a picture from the microscope.

The years which have followed those early days have seen striking developments in all forms of biological illustra-

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tion. I'm afraid that one cannot say that the progress which has been made in the quality, quantity and variety of pictures and other visual media now available to teachers is matched by an equal recognition on their part of the class room value of these tools of communication. However there is progress here too and I am confident that in a few more years visual media and technics for using them will be better understood and the lag which now exists will have disappeared. It is well to keep this in mind because all of us have our moments of discouragement when we feel like we are on a treadmill and the future looks pretty dim. Sometimes I got impatient with some of our medical people for their apparent slowness to utilize better the visual teaching materials now available to them. Then some statistics come to my rescue and my sense of futility goes away. Consider for instance that 15 years ago the only existing organization that had any reference to your profession were the BPA and the motion picture activities of the American College of Surgeons. Since then there has come into being the Armed Forces Medical Illustration Service, Veterans Administration Medical Illustration Division, American Medical Association Motion Picture Committee, Medical Audio Visual Institute and the Audio Visual Conference of Medical and Allied Sciences, not to mention other groups outside the medical field. It should cheer you too to realize that these organizations would never have seen the light of day except through the developments and growing importance of photography. Their very existence testifies to the significance of your work and links you firmly to the broad field of biological education.

This meeting in Milwaukee marks the 25th anniversary of the BPA. Certainly, in point of years, we can say that we have reached maturity. With maturity there always comes increased responsibilities. This seems to be a sort of universal law of nature and it applies to professions as well as to individuals. Knowing what these responsibilities are and how well we are living up to them is necessary if we are to grow and move forward with the times. Of course responsibility is not a one way street. Others have responsibilities to us, but it is futile to concern ourselves about this until we have put our own house in order. Respect, prestige and economic security are things we all want but they are things to be earned not demanded. How true it is I don't know but it is axiomatic in the professional world that each man makes his own job and writes his own pay check

As professions go I do not personally feel that biological photography is necessarily more unaware of its role and its responsibilities in education or is any more delinquent in living up to them than some other professions. In one respect however our association has been open to criticism for a long time. This is our slowness to set up educational standards or any kind of criteria of proficiency for members of the profession we represent. This is a duty we owe to ourselves and an obligation to the institutions we serve. These institutions have a right to expect from us, among other things, guidance in whom they employ to provide the kind of photographic service they need. Up to now we have failed them on this point. Individual members of the BPA have tried for years to get some official action of this matter of standards and certification and some interest developed in an educational program but their efforts have met with no success. I appreciate the arguments which have held us back but these argu-

ments are no longer valid. Continuing to cling to them will be construed as evidence of timidity and lack of leadership. I'm glad to say the situation looks more hopeful today than ever before. We now have a Committee on Standards which has been working diligently on this problem and is now coordinating the work of previous committees. If their recommendations have your support we may yet have standards without which we cannot rightly call biological photography a profession.

There is a second and new area of responsibility which we have to education which is now coming over the horizon. This is television. Its impact is already beginning to be felt and there seems to be general agreement that within a few years it will be in common use. Most of the medical and dental schools that I know of are planning to have television installations and provision is being made for it in new building construction on college campuses everywhere. A major and troublesome problem which the schools face is the operation of the television equipment when they get it. It is only natural that they turn to their photographers for help. I'm afraid however that at the present time the photographic profession is not prepared to actively cooperate. The job must be done though and rather than step aside and leave the whole thing to the engineers and electricians I think you should get into the picture, and fast.

I don't know whether the operation of closed circuit television in our teaching institutions will be entrusted to photographers who will have to learn electronics or to electronic people who will have to learn photography. From our experience to date it looks like electronic personnel will anyway have to service the equipment and be responsible for its maintenance. One thing we can be sure of about television teaching of the future is that photography is going to have an important role. It may or may not operate the cameras but it must be responsible for the production of the considerable amount of motion picture film, kinescope recordings, lantern slides and other projected material that will be used and that it will also have a hand in such things as the preparation of visuals and stills which seem to be needed in such variety. The one point I want to make is that regardless of how the future shapes up we should not delay preparing ourselves for it. There is a lot to be learned and besides teachers and educators in our professional schools need help and counsel now on such matters as space requirements, installations of cable conduits, cost factors etc. in planning for future television teaching. In his fine paper at this meeting on "Color Television in Medicine" Lt. Dittman gave us a look at the future. We cannot afford to ignore the implications which it has for all of us.

A third area of responsibility which deserves our consideration is one that I've talked about at BPA meetings before. It is the need to get more illustrative quality in biological photography. Of course much of the work now being done has this quality but a glance through our contemporary journals, books, and exhibits will show how many illustrations are not illustrations at all but just photographs. There is quite a difference. The photographic *illustration* is deliberately beamed to the consumer to tell a story quickly and clearly. It is consciously *made as an illustration* with due regard to the reactions of those who see it, its fitness to the text and certain rather specific publication requirements. It means applying established principles of composition, lighting, emphasis and deemphasis, background relationships etc. to

heighten the purely illustrative value of the picture.

The measure of a picture's illustrative quality is the degree to which it communicates to others the real character of the subject whatever that subject may be. In the case of a specimen it may be size, color, shape, texture etc. To capture this character or peculiar quality, in order that it may be clearly and accurately perceived and understood by others is, to my way of thinking, the major function of scientific photography. The ability it requires is often just a mattor of common sense but it does take some knowledge of the principles of illustration. These principles should be a part of the training of all professionals who make pictures to communicate knowledge.

I'm well aware that in view of the load of routine work many of you now carry, this sort of consideration of each picture you make is impractical. It is not only impractical, it is also unnecessary because the bulk of the photographs most of you make serves as records and is seen by relatively few people, most of whom are familiar with the subject. Photograph which reach publication and display, however, have a job of communication to do often as important as the text accompanying them. They are seen by a great many people to whom they are not photographs at all but illustrations- good or bad according to how well they illustrate

There is a factor that it seems to me all serious and experienced illustrators come to know sooner or later. It is a curious phenomenon that in your business most of those who come to you for illustrations take what you give them and think it's fine. Relatively few of them are critical or possess much knowledge of illustration requirements. They are so familiar with the subject to be pictured that almost any representation of it seems adequate to them regardless of what it will mean to the ultimate consumer who will see it in a lantern slide or journal article months later. They seem to think, for instance, that all the photographer has to do is to poke the camera at the subject, click the shutter and all will be well. Their faith in you may be flattering but it doesn't make for the necessary team work between photographer or artist and author that good illustration practice normally requires. However, this apparent lack of the kind of cooperation the photographer needs and the better appreciation of his problems by the staff members of his institution is more fanciful than real. Most of it is due to the fact that your customers have no more knowledge of illustration than you do of their specialty field. They may be good research people and teachers but when it comes to the visual media to communicate their subject to others they are often babes in the woods who need your advice, counsel and help. It is here that the photographer should become the teacher. By advising them and taking an interest in their problems they will become interested in yours and a harmonious relationship will become established that will enable the photographer to function at a level which will not only make his work more pleasant and satisfactory but will make him more valuable to his institution and to medical education. The big point here is that the initiative must come from the photographer himself. The old pattern of education which demanded little from him beyond routine stereotyped pictures is changing. You are a part of the pattern and must change with it. I think you will agree with me that whatever we do to this end should be done under our own power rather than have it brought about by outside pressure

Just what is the role of biological photography in the changing educational picture? Although I have tried to point out several specific aspects of it one can only be sure of the general outline. It of course varies widely in different fields and it is being shaped by many factors. As I see it there will be a broader use of both still and motion picture photography including a more extensive use of enlargements for class room and assembly teaching as well as for television and display purposes. Phase and endoscopic photography and electromicroscophy will probably come into more general use and research in virology and other new biological sciences will require a closer kind of collaboration between photographer and research worker than the routine relationships that usually exist today. If I am anywhere near right these increased responsibilities would lead to an enlarged definition of the term biological photography which would minimize its technical aspects and emphasize its functions to communicate knowledge.

Each of you is in a position to observe the needs and trends of education in your particular environment. Wherever you work — hospital, teaching institution or research laboratory — you are a part of the machinery of education, a more important role than you perhaps realize. The services you supply often have to cover a wide range of subjects and interests, some of which may seem unrelated to the learning process. Education however has need for many different kinds of pictures, and those you make for the administrative, public relations and other non-teaching divisions of your institutions can be as important as any that comes from your studios. Another service for which the biological photographer is responsible in most institutions is projection. With the growing use of slides, transparencies and motion pictures in teaching and in assemblies the supply and maintenance of projectors and screens is an indispensible service which, in the past, has not always been fully appreciated. I am confident however that this along with the other contributions which photography can make to education will receive due recognition as you go forward.

To conclude, I hope that these remarks of a non-photographer have indicated something of the place and responsibilities of the photographic profession in the broad field of medical teaching. The views expressed stem not from any intimate knowledge of photography itself but rather from a long association with it as a medium of communication. Like all students of visual education I have had to discipline myself to regard all media with equal objectivity and to estimate the capacities and limitations of each of them to communicate knowledge and ideas. Measured by this yardstick photography must be regarded as a vital and indispensible factor in teaching and learning. I'm confident that it is destined to play a role of increasing importance in the years ahead. How well it fulfills its destiny depends upon photographers themselves. Their place in medical education will be about what they make it.

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Truth in Biological Photography*

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IN the *Poetics*, Aristotle maintained that the truth of poetry is greater and of graver import than the truth of history. By "poetry" he meant largely, but not exclusively, dramatic poetry, and tragedy especially. And we understand that the truth of poetry is greater and of graver import than the truth of history because history is only a chronicle of what has happened whereas poetry, if it be worthy of its name, is a tale of what must happen inevitably in the ethical and metaphysical necessity of causality. The course of history frequently has been determined by the accidental, the coincidental, the chance, even the capricious. But the course of the action of ethically significant poetry must be determined by necessary causation alone.

We may extend Aristotle's doctrine to embrace other forms of art. Indeed, it is possible that he himself had done this in another work no longer extant, or in the *Poetics* itself, which is only a fragment of a larger treatise. We may say, then, that the truth of painting or sculpture is greater and of graver import than the truth of photography, and this doctrine will apply even to biological photography. Yet how is it possible for another form of representation to possess greater truth, and truth of graver import, than does photography? Did not the sensitive film record materially and truthfully all that was visible within the field photographed?

It did, of course; and in art this kind of recording is realism or naturalism. One of the most ancient of art objects known, the so-called Venus of Willendorf, is of this nature. No doubt the maker of this image (Fig. 1) did the best he could, but assuredly his representation is not that of womanhood, nor of feminine beauty, as the world has understood these. He has given us only a woman—very probably his woman—but not what we look for in art. His work is individual, not universal. But the figure of the Venus of Milo and the face of Murillo's Madonna are endowed with beauty inescapable. Had the model for either of these been photographed, it is all but inconceivable that the picture would represent feminine beauty, or womanhood, as completely and as significantly as does the statue or the painting. We must think, then, that these art forms are not photographically true and of grave import they are more than photographically true, and their import is graver than that of any photograph.

We know that Alcmæon of Crotona performed dissections in the fifth century before Christ, and that he discovered the optic chiasma. It is not much to assume that he made a drawing of the chiasma for his own use and for the use of his followers and students. But in a thousand years the lamp of classical civilization had burned low and the remnant of Greek medicine went with the Ne-

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Figure 1. The "Venus of Willendorf." Prehistoric stone statuette.

torian Christians into exile in a remote corner of northeastern Iran. And Alcmæon's representation of the optic chiasma became more and more traditional and more and more stylized until it formed a favorite motif for the ornamentation of rugs (Fig. 2).

Virtually all medical illustration met the same sad fate. Five, sometimes six, stylized pictures—sketches, rather—comprised nearly the whole of it. These were representations of the skeleton, the muscle-man, the artery-man, the vein-man, and the nerve-man. If the sixth sketch were present, it was a crude and medically useless representation of a pregnant woman (Fig. 3). Since printing had not been discovered, these crude drawings were copied by scribe after scribe from manuscript to manuscript until they had become worthless. They were not drawn from dissections, not from nature; they are doubtless the deteriorated and degenerate copies of copies of yet other copies of ancient Greek originals which had been made for, or by, Alcmæon of Crotona and his contemporaries and his successors in the great eras now all but forgotten.

Yet the teacher used these wretched sketches for instruction. They were all he had. And medicine was taught by reading it from a manuscript of a work usually by Galen, and illustrating the reading with these drawings. Quite rarely a cadaver was dissected, usually before the populace in the public square: the professor would read from Galen the description of the parts being dissected while giving to the town barber instructions on the manner of dissecting. If the dissected parts were found to differ from the descriptions of Galen, this was because the human body had changed since Galen's time!

With the increasing popularity of astrology some new but still crude drawings came into being, intending to show in what manner the parts of the body were under the influences of the signs of the zodiac.

But if the field was lost, all was not

Figure 2. The optic chiasma. From Mosque MS 924, Istanbul.

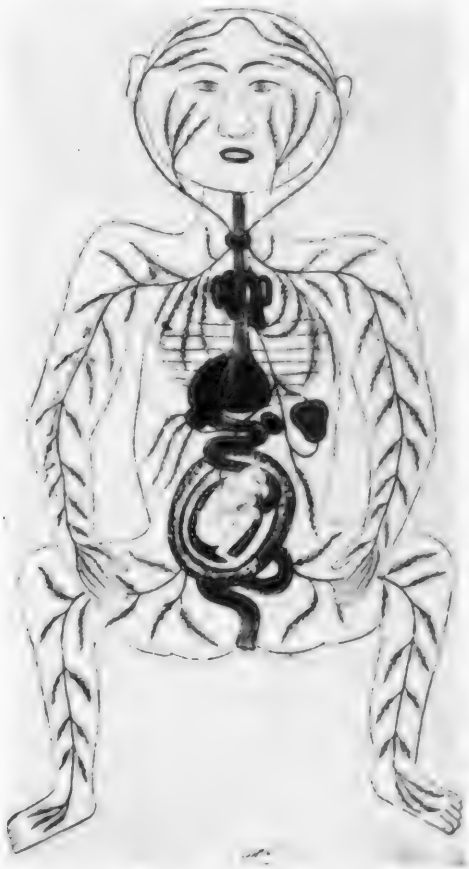

Figure 3. Pregnancy. From Persian MS 2296, India Office, London.

lost. If most of the scribes and the professors and the doctors and the students were content with the five or six stylized traditionals, or with miniatures nearly useless, or with wretched new zodiacal efforts, one finds nevertheless an occasional manuscript whose illustrator-scribe felt within himself the urgent desire of the artist. Then he would decorate his initial letters, he would adorn the margins of his leaves with brightness of color and movement of line, he would give to his medical figures what beauty and grace he knew and could master. (Fig. 4). A new tradition was making. It arose not among the men of medicine, but among the artists.

During the last half of the fifteenth century Leonardo da Vinci was making beautiful drawings which were anatomically correct. But the makers of the medical books knew nothing of these; indeed, they were lost to the world for more than two hundred years.

But other artists, and some even in the fourteenth century, were producing painting and sculpture in which the human figure, and parts of the human figure, were represented accurately and also beautifully. We recognize that the art of the Renaissance was realistic: so realistic was it that the physicians of Italy used to study the artists' paintings to learn the locations and the courses of the veins from which they must draw blood in their treatment of the sick. They could learn these things better from a work of art than from an illustration in a book on anatomy or medicine.

The union of art with medicine occurred at last when Charles Estienne of Paris in 1530, and Andreas Vesalius of Padua about 1538, engaged artists to make the illustrations (woodcuts) for their books on anatomy. Estienne was earlier in point of time, but publication of his work was delayed until 1545 because of a protracted legal dispute. Vesalius' book was published in 1543. It quite overshadowed Estienne's, not because it had been published earlier, but because Vesalius had for his artist Jan Stefan van Kalkar, one of Titian's pupils, while Estienne had only the obscure Etienne de la Riviere of lesser talent. Yet Estienne and Vesalius had studied together at Paris during three years, and it is possible, even probable, that but for Estienne there had been no Vesalius.

Although we recognize that the art of

Figure 4. Marginal decoration, fancy initial, and female figure, in color. From Dresden MS 78.

the Renaissance was realistic, it was not therefore photographic. Like ancient Greek art, it had much of the local and the temporal; but, again like ancient Greek art, it possessed universality nevertheless. This brings us around again to our extension of Aristotle's teaching: the truth of painting is greater and of graver import than is the truth of photography.

How shall we resolve this seeming contradiction in terms of biological photography? This, perhaps, is not too difficult. For the biological photographer is not just a technician. He is not just a man who knows the comparative sensitivities of different emulsions, who knows how to adjust a camera to a microscope, who knows the potentialities of infrared and ultraviolet and the reaches of the visible spectrum, and the like. Least of all is he merely the agent who opens a shutter upon a specimen brought in by a pathologist or other specialist who wants a photograph.

The biological photographer is he who knows the meaning of composition, of symmetry, of significance, of light and shadow, of object against background, of posing, of tonal effects, of the hundred factors which enter into the final effect. Such a man must employ to his utmost the highest faculties of the mind: he must think, he must judge, he must discriminate, he must abstract the essential truth of the object being photographed. And the more nearly and clearly he abstracts the essential of the object, the more effectively will his picture reveal truth which is great and of grave import.

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Tripod and Focus Mirror For Operating Room Use*

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Introduction

Photographing surgical procedures, especially in the depth of the thorax and abdomen, poses a problem of positioning and lighting. Perspective distortion of the subject from an angle position is undesirable. Superior scientific illustrations of the anatomic or pathologic condition are made from a right angle view of anterior, posterior or lateral positions Therefore, a study tripod that will angle over the operating table at 90° is a prerequisite. Complicated and expensive counterbalanced tripods are available. We have, however, adapted a satisfactory, easily manipulated tripod with little or no expense

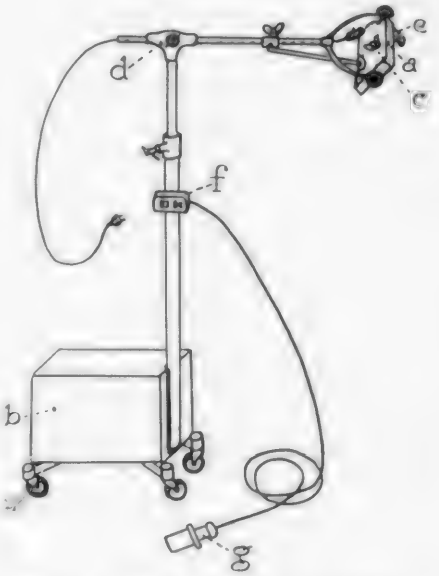

Figure 1. (See text for explanation).

Description of Tripod

Utilizing a defunct emergency portable operating room light which carried batteries at the base, we mounted a board carrying a tripod screw in the space where the reflector lamp served (Fig. 1a). The batteries at the base of this light stand (b) made it ideal for a tripod as they now serve to counterbalance the camera which is attached to the tripod head (c). The photographer may also stand on the base if necessary. This lamp stand has a right angle arm (d) which adjusts in height and which rotates, making it possible to swing the camera over the operative field after the base is in position.

Focus Light

Although strobe light is usually used for photographing exposed surgical fields, a focusing light in deep cavities is essential. Mounted on the board carrying the tripod screw is a 100-watt bayonet base type focusing light with a reflector

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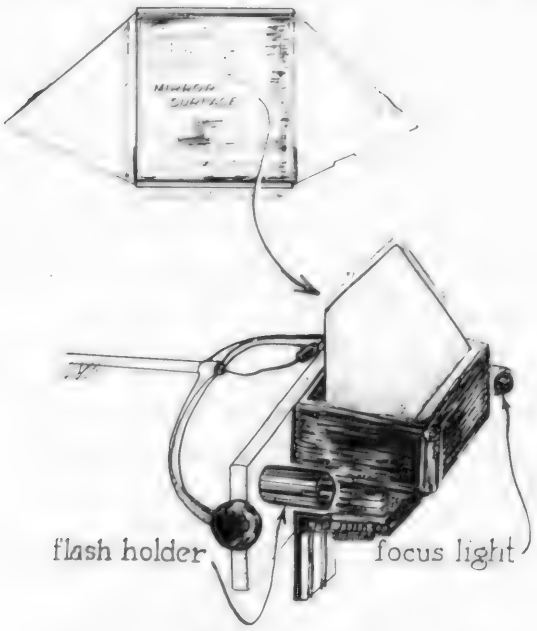

Figure 2. (See text for explanation).

made of light weight aluminum (e). This affords adequate illumination for clear focusing. The electric outlet cord is threaded through the right angle arm and the plug is attached to the outlet box (f) on the upright which carries the explosion proof plug (g).

Reflected Focus Mirror

In order to enable the photographer to focus on the ground glass of the *Speed Graphic* without necessitating his climbing to a position directly over the operative field, a mirror 5 in. x 6 in. has been mounted on a light weight piece of aluminum (Fig. 2). By cutting the aluminum 1/4 inch wider than the mirror on each 5 inch horizontal side to allow for bending over to secure the mirror, and allowing a 4 inch triangular wing of aluminum at each 6 inch vertical end of the mirror to bend at right angles, the mirror is mounted, without danger of falling, on the focusing ground glass. The surgeon is able to view the exposure on the ground glass as he steps back from the operating table. This allows the photographer to focus on his field without danger of contamination to the surgeon or the field.

Adjusting the shutter is somewhat unhandy without direct view. A tiny chip of adhesive tape placed on the f-stop of the lens before the camera is mounted facilitates adjustment of the stop by feel.

Summary

An inexpensive easily manipulated tripod for operating room use with a reflected focus mirror attachment for the camera have been described. Photography in deep cavities is facilitated from a desirable right angle view thereby avoiding any perspective distortion

A New Monochrome Application For a Highlight Mask*

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QUALITY should be given top priority in *all* biological photography. Reproductions of artists' illustrations and medical radiographs should not be exceptions.

In conventional copying methods, the quality loss is most evident in the lack of gradation in the highlights. This loss may be largely compensated for by use of a so-called "highlight" mask. The highlight masking procedure in the *Kodak Dye Transfer Process* is known to most photographers, either through practical experience or the literature. In this process, the highlight mask is made from the transparency. Masking in black-and-white photography, however, is done from the original, whether it is flat copy or a three dimensional subject.

For an understanding of the highlight mask it is helpful to have experience in copying a gray scale. A test "masking" negative should be exposed so that three "steps" of a conventional gray scale are visible, beginning with the white. If more than three steps are recorded, a little reducing may be necessary. Thereafter, under the same conditions of exposure and processing, a good mask may be made consistently for any illustration or photograph. A *Kodalith* film mask, according to gray scale tests, proved to be suitable when developed in *Kodalith* developer.

The highlight mask, so produced, is visually registered with the principal negative over an illuminator, and the negatives are then taped together for printing. These combined negatives produce the necessary separation of white and adjacent delicate tones (Fig. 1).

When a copy is made of a *Kodak Gray Scale*, preserving tone separation at both ends of the scale (Fig. 1b), then a copy, regardless of contrast, should look much like the original. For continuous tone illustrations and photographs, *Kodalith* or *Highlight Masking* films are well suited. The exposure should be such that only the whites and near whites are recorded.

Merits of highlight masking are illustrated in Figure 1: (a) Kodak Gray Scale (original); (b) a photographic copy of original with the highlight mask; (c) a photographic copy of original scale without the use of a highlight mask. The principal negative exposure was long enough to register a slight amount of tone in the dark end of scale in photo (b) using *Royal Pan* film with soft development. A *Kodalith* film highlight mask was exposed for the white end of scale and registered for the final print. This print compares favorably with the original scale (a). The cardboard on which the original gray scale was mounted is slightly warm toned and the use of ortho-

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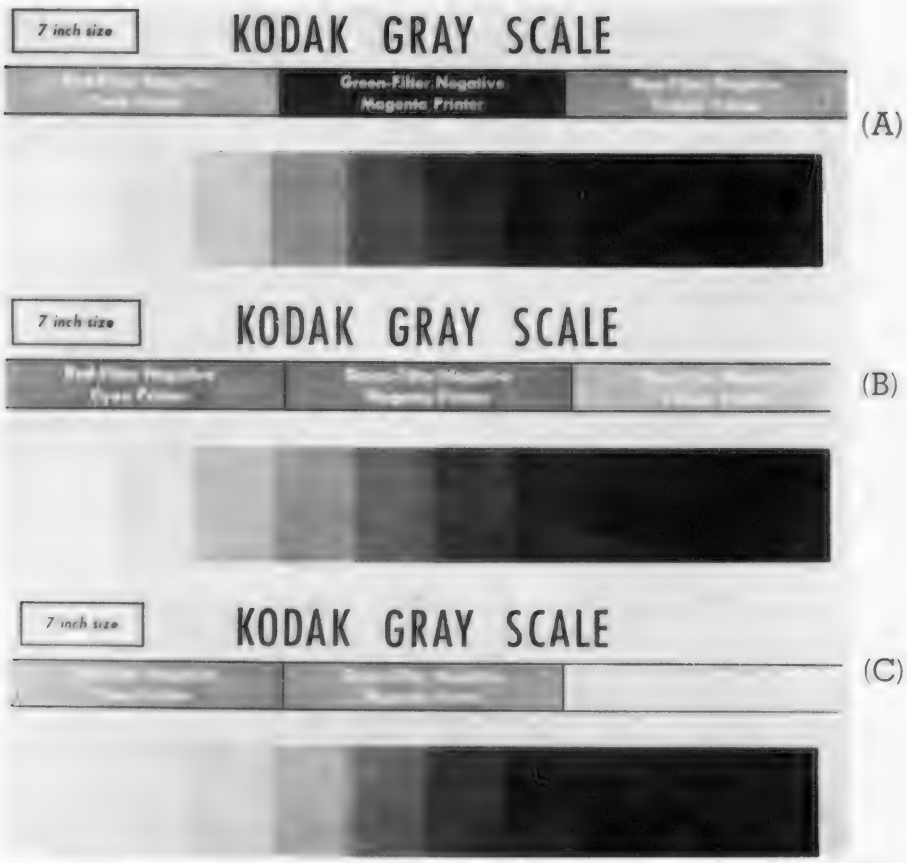

Figure 1. (A) Original Kodak gray scale. (B) Photographic reproduction of scale utilizing the highlight masking technique. (C) Photographic reproduction of gray scale showing approximate tone separation obtained by conventional methods.

chromatic film for the mask accounts for the pronounced separation of tone between the white division and background (Fig. 1b).

The masking technique is particularly useful in the copying of continuous tone illustrations drawn by medical artists. It is their illustrations that suffer most under the usual photographic techniques, especially if lettering and legends are included. For such illustrations the highlight masking technique is always recommended, regardless if the original is in color or black-and-white. This technique has been used by us for about two years with excellent results in copying and in photographing three dimensional subjects.

Figures 2 and 3 carry out the same principal as in Figure 1, the only variation being that a K-1 filter was used in exposing the principal negative. Many illustrators mix red or brown with black, thereby creating a warm tone which has to be filtered out for best results. In these figures, (a) is the original draw-

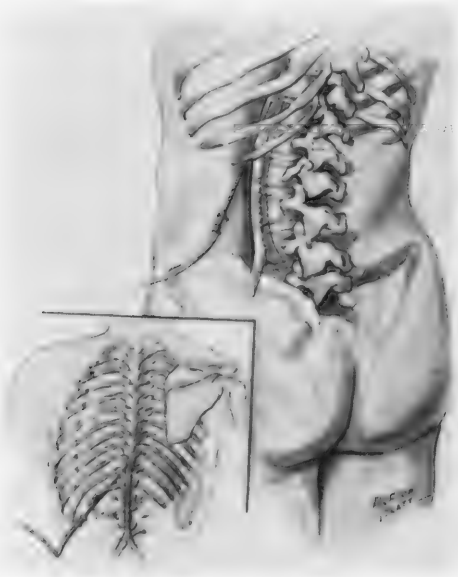

Figure 2. (A) Original artist's illustration.

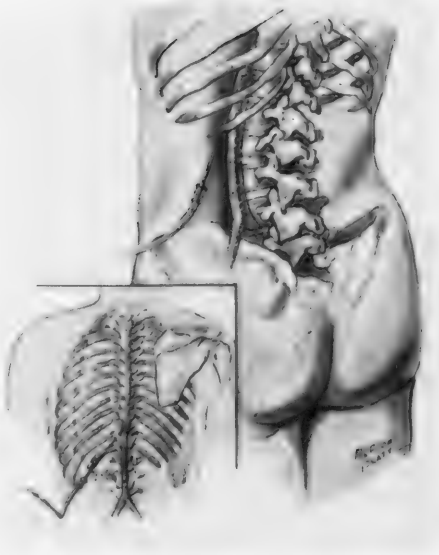

Figure 2. (B) Reproduction of artist's illustration utilizing highlight masking technique.

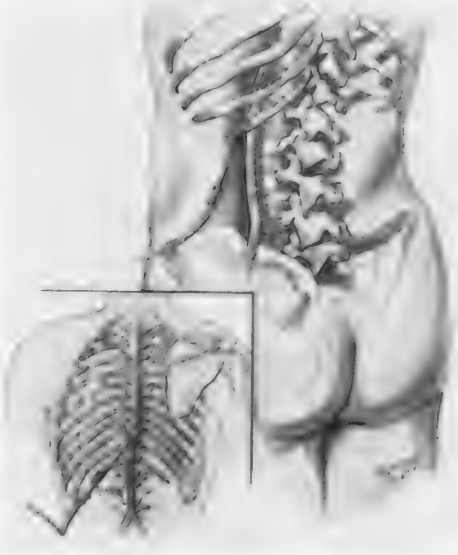

Figure 2. (C) An average quality reproduction of illustration by conventional methods.

ing, (b) is a copy using a highlight mask, (c) is an average good quality reproduction of the original drawing as obtained by conventional methods. Again there is a marked range of quality between (b) and (c). The quality of the originals is preserved in (b) only. It is interesting to note that photos (b) of Figures 2 and 3 were printed on *Velox F*, No. 0 paper. These possess more brilliance and contrast than photos (c) which were printed on *F2* or average grade. The principal negative film for all figures is *Kodak's Royal Pan*. This new long scale film enables the photographer to record shadow detail and, when developed soft, the highlights or high key areas in the negative are not blocked by the full exposure necessary for recording of the darkest tones.

The light value was read from a white card placed over the original material with a *Weston* meter which read just below the 200 frame or 160. Exposure was one-half second at F/32. The copy scale was 1:1 and exposure factor 4X. Development was five minutes at 68F in a tray of pyro developer. Two-thirds of the required amount of solution "c" or carbonate was used to control negative contrast. Pyro developer, *Kodak D-7* is of the three solution type, giving the photographer a wide choice in development, from soft to contrasty negatives. In this case, soft negatives were desired and were obtained by using less carbonate, not by underdevelopment or dilution as with other single solution types. With lighting and all other factors remaining the same, the *Kodalith* film mask was exposed at F/11 for one second and developed in *Kodalith* developer for three minutes at 68F.

In Figure 4, copies of radiographs in the top row show good average results obtained by conventional methods, while the second row shows improved results

Figure 3. (A) Original artist's illustration. (B) Reproduction of artist's illustration utilizing highlight masking technique. (C) An average quality reproduction of illustration by conventional methods.

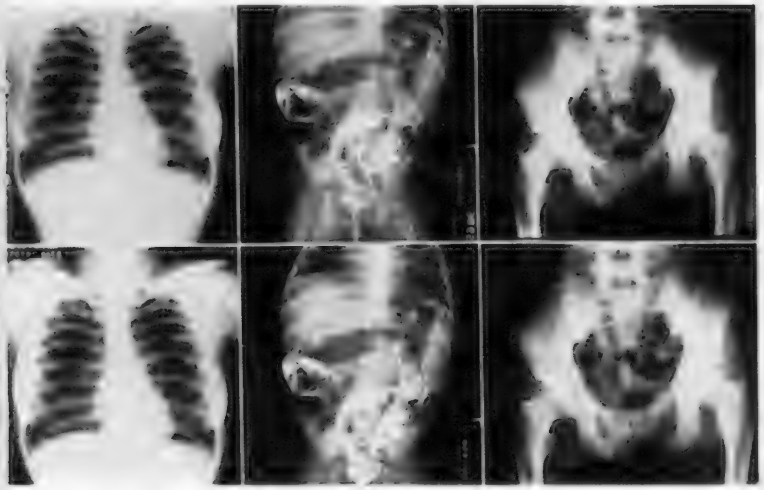

Figure 4 *(Top Row)*. Good average quality reproductions obtained by conventional photographic methods. *(Bottom Row)* Reproduction by highlight masking technique without "dodging", "printing in" or any other manipulation.

by use of a highlight mask and pyro development. Instead of using two-thirds of the required amount of solution "c", only one-third was used and developed three and one-half minutes. Our illuminator has a light value of 100 on the *Weston* meter. The exposures were on 5 x 7 in. film at F/22 for fifteen seconds. The highlight masks were exposed for ten seconds at F/16 and developed four minutes. Because the highlight intensity is much greater in radiographs, *Kodak Highlight Film Developer* should be used. *Kodalith* developer would produce a mask too dense for practical use. As previously stated for Figures 1, 2, and 3, the best results are obtained on No. 0 or No. 1 papers in contact printing. In Figure 4, the chest X-ray is a high key type, the torso is an average type, and the pelvis, one of the most difficult of radiographs to copy, is also average. The quality difference in the masked and unmasked prints is obvious, and well worth the extra sheet of film considering that "dodging" and "printing in" during exposure and printing is unnecessary. The range between highlights and shadow areas is much greater in X-rays than in continuous tone illustrations, therefore, a true reproduction is more difficult. Because of this high range the intermediates must be softer than copy negatives of other subjects and, therefore, a highlight mask is needed for the separation of delicate tones and white. A photographer may employ a number of tricks in fancy "dodging", meter readings, developing, choice of films, etc., but the results are consistently inferior to those obtained by use of a highlight mask and properly made intermediate.

After some acquaintance with this two-film highlight masking technique, the photographer shall be rewarded by consistently improved quality of his copies. The time worn dictum, familiar to all photographers, may now read like this: "Expose for the shadows, and let the mask take care of the whites."

Acknowledgement

Artist's illustration by Mr. Morton Blatt, Veterans Administration Hospital, Wood, Wisconsin, who so kindly loaned them for this paper.

[1] [1] [2] [3]
Color Separation and Masking, Eastman Kodak Company, 1st Ed., 1951

A Device for Rapid Photomicrography*

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Lying-In Hospital, Chicago, Illinois

STUDYING fresh, unfixed cellular material the cytologist himself is very often obliged to perform a photomicrographic recording of his findings, because of rapid disintegration of the material. We deal with this problem particularly in studies of unstained fresh cellular material under the phase-contrast-microscope or interference microscope. Here microphotography provides the only means of preserving the initial findings for cancer screening, research and also is the only possible method of making a comparative study for hormonal interpretation of the cytologic smears. Not infrequently in photomicrography, the cytologist encounters difficulties due to over or underexposure, incorrect focus, blurring due to jarring or vibration during time exposures and so forth. By the time faulty negatives can be detected by conventional darkroom developing and printing methods, unfixed or fresh cellular material will have been destroyed and a repetition of the photograph is impossible.

For these and for some other special occasions, e.g., photomicrography of tissue cultures, of fresh bacteriologic material, or of cellular material dyed with unstable fluorescent stains, a device for rapid photomicrography can be of great aid.

It is therefore the purpose of this paper to describe such a process as the one which we employ ourselves, and which is of great use in our Laboratory of Exfoliative Cytology.

Necessary parts are shown in Figures 1 to 3, as follows: (1) Microscope with strong illumination (we use Zeiss microscopes with phase contrast attachments and transformers with an overcharging device or a *Baker* interference microscope with a Zeiss high pressure mercury lamp). (2) *Leitz* photomicrographic attachment with an 8 X or 10 X ocular (without the 36 x 24mm camera,' but with the shutter and the swing-out prism). (3) *Linhof Technica* 4 x 5 inch camera without any lens, but with a special lensboard for photomicrography. (4) *Linhof* accessory stand. (5) *Polaroid Land* camera back with attachment to fit 4 x 5 inch cameras.

Figure 1. Device for rapid photomicrography. The device consists of a Linhof Technica 4 in. x 5 in. camera mounted on the Linhof accessory column. The lens board of the camera contains no lens. On the straight tube of the microscope is the Leitz Micro Ibso, the conical tube of which fits into the empty lens board of the Linhof Technica. The microscope shown here is a Zeiss phase contrast microscope.

These listed parts are standard products of the respective factories. The only mechanical change which has to be made on the parts is in the ocular of the *Leitz* camera attachment. This ocular is produced to fit a 36 x 24mm camera for a much shorter focal length. To adjust the ocular for use on the *Linhof*

*Received for publication July 13, 1955. Supported by an Institutional Grant from the American Cancer Society and by the Goldblatt Cancer Research Grant

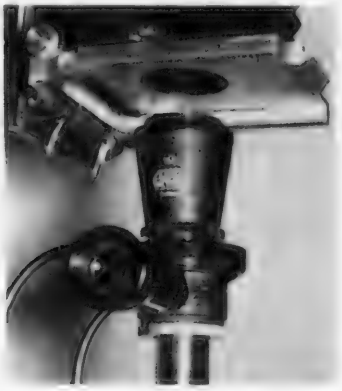


Figure 2. Empty lens board of Linhof Technica fits over conical tube of Leitz Micro Ibso, providing shutter.

Figure 4. The Linhof spring back was removed and is being replaced by the Polaroid Land back.

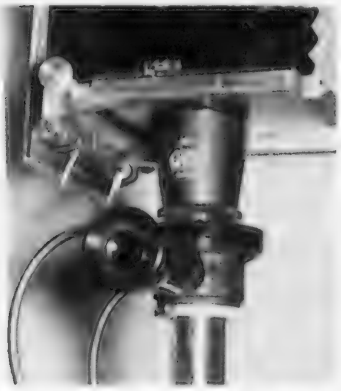


Figure 3. The lens board is lowered over the Micro Ibso making the device light proof.

Figure 5. If negatives are required, Polaroid Land back is removed and replaced by Linhof ground glass attachment.

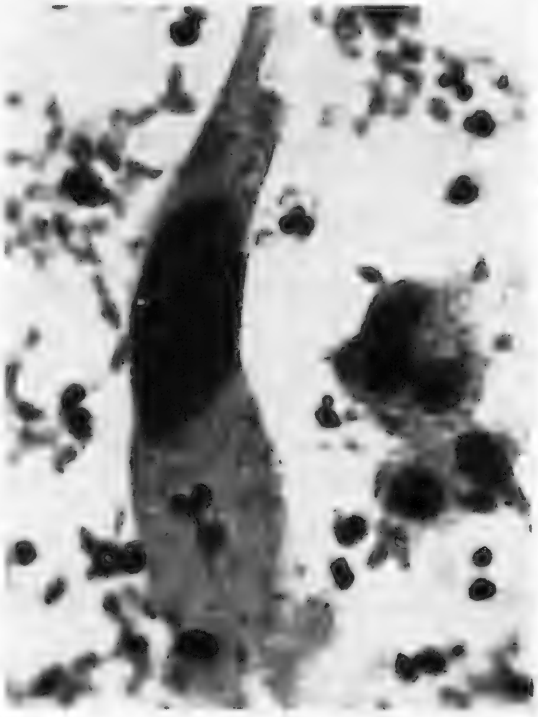
camera with the *Polaroid Land* back we must first put a ground glass in the *Polaroid* back. If the picture is in focus on this ground glass the ocular of the *Leitz* camera attachment must be unscrewed and corrected until the picture is also in focus here. To avoid a change in this correction of the ocular, it is advisable to fix the ocular in place with a piece of cellophane tape. If both pictures, on the ground glass of the back and in the ocular, are in focus, the screws of the *Linhof* camera mount are then tightened and the photomicrographic device for rapid recording is ready for use. The positive print is ready sixty seconds after exposure. This is such a short time that practically none of the cellular material has a chance to disintegrate before the finished print can be inspected. Any focusing or exposure error can then be corrected on the spot and a new print can be made immediately, while the cellular material still retains its natural appearance. The cost of each exposure by this method is about twenty-two cents.

One of the major advantages of this particular equipment for photomicrography is

that it can be adjusted for 4 x 5 inch photography on conventional negative films in a matter of seconds, should the necessity arise. Using *Kodak Ortho-X* 4 x 5 inch sheet film, which has approximately the same speed as the Polaroid film, the latter can be used for correcting exposure time, and for determining the effect of filters.

Summary

A device for rapid photomicrography, using a *Linhof Technika* 4 x 5 inch camera with its *Polaroid Land* camera attachment and a *Leitz* camera attachment is described. This device can be of substantial value for microscopic studies on fresh material with a relatively rapid disintegration (e.g., fresh cell studies under the phase contrast microscope or interference microscope) where photomicrography is the only means of recording and comparison. This device can immediately be changed to conventional 4 x 5 inch negative film exposures.



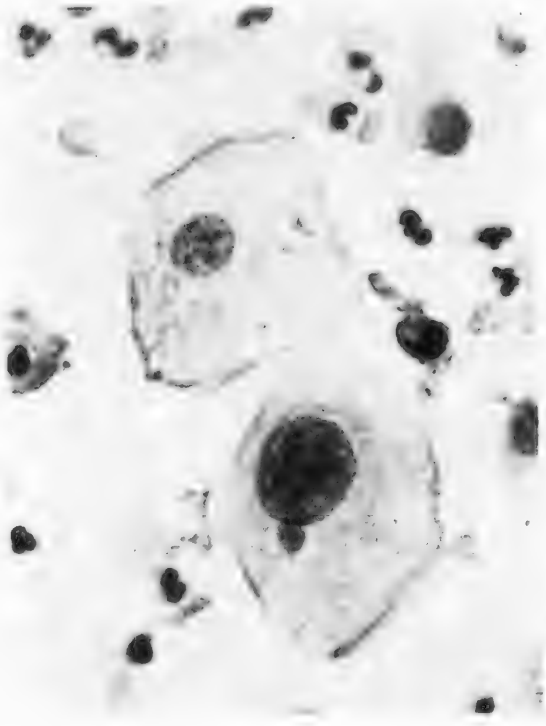


Figure 6. Two photomicrographs of cytologic smears of the female genital tract made with the described device. The photograph at the left shows two normal squamous epithelial cells of deep cellular layers, whereas photograph at right exhibits abnormal cells: squamous epithelial carcinoma. 90X oil immersion, 10X ocular.

Journal of the Biological Photographic Association Vol. 23, No. 4 November, 1955

Four Bridges to Cross

How the American Instructional Film Goes Abroad*

WILBERT H. PEARSON

U.S. Information Agency, Washington, D.C.

EVERY year finds new demand from educators and scientists abroad for American motion pictures, filmstrips and all types of visual and auditory materials. But free international circulation of needed materials is impeded by such a complex of problems, that a number of producers still are unwilling to encourage requests from abroad.

Nevertheless, despite the problems, some five hundred American producers are now making their productions available for sale, rental or loan upon acceptable order from abroad, and their number appears to be increasing. Certainly the export of such privately and commercially distributed materials increases yearly, and now stands at seven times its annual pre-war volume.

This steady increase in the face of obstacles is most encouraging to those who believe that every film which goes abroad contributes to our international relations when it provides a better understanding of America, when it illuminates some aspect of the technical accomplishments, the moral and social values, and the aspirations of the American people.

Such ideas on film often stay at home, however, for one or more of the following reasons:

(1) Customs duties and various taxes in many foreign countries are so great as to make importation abroad almost impossible unless the material can first be established as educational.

(2) Many materials do not go abroad because foreign film users simply have not been made aware of new materials available.

(3) Very often educators and scientists abroad lack U. S. dollars, and are unaware of means of converting their own currencies to obtain them.

(4) Certain producers do not make their materials available on loan or rental outside the United States, because they have in the past encountered problems in effecting return of their films through United States customs.

There are several bridges designed to help American privately produced materials to cross over these obstacles to free circulation.

(1) *Educational Certificates Help Overcome Customs Barriers.* A number of governments have entered into international arrangements or have provisions in their customs laws which enable them to recognize certificates of exporting countries establishing the international educational character of motion pictures, filmstrips, and other visual and auditory materials. Materials thus certified may enjoy duty free entry, freedom from sales taxes, and other customs facilitation that such arrangements specify.

For more than a quarter of a century attempts have been made to arrive at an arrangement acceptable to all countries. The most recent of these, the *Agreement for Facilitating the International Circulation of Visual and Auditory Materials of an Educational Scientific and Cultural Character* (Beirut, 1948), came into effect in 1954, and has been ratified by: Cambodia, Canada, Denmark, Greece, Haiti, Iraq, Norway, Pakistan, Philippines, Salvador, Syria, and Yugoslavia.

In addition it has been signed by: Afghanistan, Brazil, Dominican Republic, Ecuador, Iran, Lebanon, Netherlands, United States of America, and Uruguay.

It provides for exemption from customs duties, and quantitative restrictions, and from the necessity of applying for an import license" on the following classes of materials:

(a) Films, filmstrips and microfilm in either negative form, exposed and developed or positive form, printed and developed.

(b) Sound recordings of all types and forms.

*Received for publication February 10, 1956.

(c) Glass slides; models, static and moving; wall charts, maps and posters.

Article I of the Agreement provides that visual and auditory materials shall be deemed to be of an educational, scientific and cultural character

(a) When their primary purpose or effect is to instruct or inform through the development of a subject or aspect of a subject, or when their content is such as to maintain, increase or diffuse knowledge, and augment international understanding and goodwill; and

(b) When the materials are representative, authentic, and accurate; and

(c) When the technical quality is such that it does not interfere with the use made of the material

Recognizing that for lack of a formal certification program, American audio-visual materials were being seriously disadvantaged abroad, the U. S. Information Agency now attests to the international educational character of visual and auditory materials upon application of the American owners of reproduction rights. Some thirty-five governments now recognize or "find helpful" certificates issued by the Agency and grant to materials covered by them freedom from customs duties, sales taxes, and such other privileges as their customs laws permit. Criteria for eligibility are set forth in *Code of Policies and Administrative Procedure* as published in the Federal Register, December 24, 1953.

(2) *Catalogs and Film Festivals Help Circulation Abroad*

Another assist given by the U. S. Information Agency to the international circulation of visual and auditory materials is the publication of the catalog *United States Educational, Scientific and Cultural Motion Pictures and Filmstrips Suitable and Available for Use Abroad*. A current edition now in preparation is expected to list some 10,000 motion pictures and filmstrips from more than 500 American sources. Each item has been declared available for use abroad by the American distributor concerned, and has been approved for inclusion by American visual educational specialists. Much of the descriptive catalog data for the publication is being obtained from cards issued by the Library of Congress as a part of its cooperative cataloging program. Catalogs are made available to ministers of education, audio-visual centers, principal educational, scientific and cultural institutions and organizations abroad.

A number of producers have recognized that international film festivals, such as those at Edinburgh, Venice, and Berlin provide opportunities to bring non-theatrical educational films before international audiences. Regulations and reports of each of the festivals are published and are worth study by any producer of educational and scientific films who is interested in effecting their international distribution.

(3) *Coupons and Guarantys Counter the Currency Problem*

Individuals and institutions in soft currency countries have great difficulties in obtaining the necessary United States dollars to purchase American goods. The United Nations Educational, Scientific and Cultural Organization has devised a coupon plan which enables such institutions and individuals to obtain educational, scientific and cultural materials from hard currency countries. Among these materials are motion pictures, filmstrips and in some cases projection equipment. Some twenty-two countries are now participants in this plan which has been responsible for effecting the international circulation of millions of dollars worth of educational, scientific and cultural materials. American producers receiving coupons in payment for their materials may redeem them for American dollars at UNESCO New York Office, UN Building, New York 14, New York.

Another method of relieving currency convertibility problems is the Informational Media Guaranty Program, administered by the U. S. Information Agency. The Program makes it possible for American producers of informational media, including visual and auditory materials, to obtain guaranty of convertibility to United States dollars of money earned in certain countries through the sale of such materials.

(4) *Return Ticket for Exported Films Customs Form 3311*

Rental or loan of educational films abroad involves making arrangements for their return. Failure to do this often results in delays and expense. The complete procedure is set forth by the Bureau of Customs, Treasury Department, in *Circular Letter No. 2859*, on the subject: "Entry requirements

for American-made films exported temporarily on a rental or loan basis."

The key to the new procedue is *Customs Form 3311*.

The following are the recommended steps:

(1) Obtain *Customs Form 3311* from the U. S. Customs Office in your area before you ship the film.

(2) Fill out and execute the form, making the following statement in the "remarks" section:

"It is requested that all other forms required by section 10.1 of the regulations be waived. These films contain no obscene or immoral matter, nor any matter advocating or urging treason or insurrection against the United States or forcible resistance to any law of the United States, nor any threat to take the life of or inflict bodily harm upon any person in the United States."

(3) Affix the form to the outside of the film can or container in an envelope marked "Documents for U. S. Customs." Tell the consignee to see to it that the form is still on the can *when the film is returned*

(4) The customs officer at the port of entry will remove the form when the film is returned, and find on it all the information he needs to enable him to admit the film duty-free.

The procedure applies to shipments of educational films produced in the United States, returned from abroad to the United States sender by *mail*, and valued at not to exceed $250

Many barriers to the free international circulation of visual and auditory materials still exist, but American producers of visual and auditory materials may wish to be more fully acquainted with the location and capacity of the bridges which strive to overreach them

MEDICAL AND BIOLOGICAL ILLUSTRATION

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January, 1956

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Design of a Slide Mounting Table*

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V.A. Hospital, Ann Arbor, Michigan

IN any photographic laboratory where a great deal of slide masking and binding is being done, the problem generally arises as to the most efficient method of doing the job. Some of the methods generally in use today are: an X-ray view box on a desk or on an open drawer of the desk, or a light box built into the desk drawer itself.

While these methods may be adequate they do not fulfill the requirements of the laboratory that under a normal work load would turn out several dozen lantern slides daily. Having to chase after materials that are stored in another desk, cabinet or even another room tends to cut down on the efficiency and quality of the whole operation. A desk cluttered with masking and binding materials could be used for little else until the slide masking and binding was completed.

The answer lies in a compact unit with drawer space provided for material storage and a transilluminated working area in the top for viewing the work to be done. The unit described here can, for lack of a better name, be called a "slide mounting table."

This slide mounting table is of standard desk height and width and contains three drawers, a minimum of 4 inches in depth, to facilitate the storage of materials used. Lantern slide cover glass, masks, binding tape, opaquing medium and other materials are readily available when needed.

The use of fluorescent tubes, mounted on asbestos, as the illuminant eliminates any discomfort due to excessive heat arising from the light source. Five 20 inch fluorescent tubes evenly spaced are used, mounted beneath the opal glass working area. Removal or replacement of burned-out tubes or starters is accomplished by lifting the opal glass from the table top.

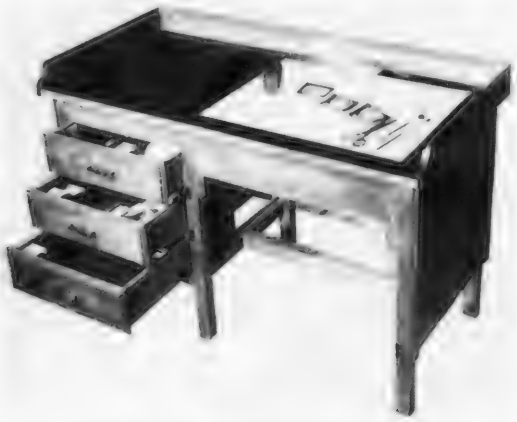
The light diffusing property of the opal glass top tends to eliminate discomfort due to eye strain even after prolonged periods of viewing. A switch on the front underside of the table controls the light source and is easily accessible when one is seated at the table.

Using a frame construction, the desk is covered with 1/8 inch plywood (3 ply) on the sides and back, while the top is 3/4 inch plywood (5 ply). The top is also covered with 1/8 inch tempered masonite to give a smooth hard working surface.

A 3 inch rail around the sides and back of the table top helps to keep materials from being inadvertently pushed on to the floor.

A paint or natural stain finish to conform with other furniture in the room and chrome drawer pulls complete the unit

The slide mounting table may be put to many uses other than slide masking and binding. It lends itself very well to negative opaquing, tracing onto mimeograph stencils, comparison of slides or groups of negatives and numerous other procedures requiring transillumination. The ease with which slide binding, etc., can be accomplished will be readily apparent, as will increased quality of the finished product.



*Received for publication November 29, 19

Projection Practice*

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Department of Medical Illustrations, Hitchcock Foundation, Hitchcock Clinic and Dartmouth Medical School, Hanover, N. H

PROJECTION of medical material has grown from the *Magic Lantern* run by a volunteer in the audience to the most frequent outlet for medical photographs. Only one in a hundred of the biophotographer's prints, may be published or exhibited, whereas films and slides are projected over and over again. Projection is frequently used to illustrate a paper describing a new advance in medicine long before it reaches publication in which only a fraction of its original illustration appears. Physicians see so much projection that, without always distinguishing faults of projection from faults of photography, they have become a critical audience.

Hall Requirements

Space, shape and seats usually are fixed conditions, amenable only to alteration and rearrangement. When new design is possible, manufacturers of projectors furnish helpful information. Most rooms can be adapted to passable projection, but the ideal room is 5 units long to 3 wide, with lengthwise central projection. The best seating area is along the projector-screen axis, between distances roughly equal to 2 and 5 times the width of the screen image. Up to the distance image width 5X the slide which is properly prepared and adequately illuminated, is legible with 20/20 vision. Closer than image width 2X, the eye cannot fix the whole image and must scan. Thus, to accommodate a larger audience one increases screen image, adds rows of seats at the rear and subtracts one front row for each 2-3 rows added. Illumination must increase correspondingly.

Lateral boundaries of the seating area cannot be set so exactly as the fore-and-aft. The spectator in a seat only 1° off the axis of projection will see a distorted image but the distortion is imperceptible. At 89° there is the same kind of distortion but so much of it that the image is imperceptible. Somewhere in between is the practical limit. However, the mind compensates for considerable angular distortion, so this limit is not only inexact but is subjectively variable. Most spectators accept an angle of not more than 30° which gives a total seating area of 60° with matte screen (with beaded screen the angle is 20° and area 40°). Incidentally, curved rows obviate twisting the neck but do not correct optical distortion.

Thus the room which is broad but not deep, a shape satisfactory enough for casually watching a lecturer, is less satisfactory for viewing projection than the longer, narrow room. The best seating arrangement is the piece-of-pie, cut more to a commercial than a maternal angle.

Existing rooms often can be improved by rearranging seats, by changing the projection axis (not forgetting possibilities in the diagonal of a square room), or by substituting side aisles for a center aisle. A center aisle, of course, wastes the best viewing space.

Darkening

During projection, room illumination should not exceed 0.1 foot candle with no direct light reaching the screen. The room with a ventilating system can be darkened by opaque roller shades, preferably operating behind wooden baffles. In the unventilated room, opaque curtains can be hung in from the wall on rods, attached along the sides but with openings over and under for circulation. The darkening mechanisms of rooms designed for B & W projection may need modernization for color projection. There is no better way of spoiling a paper, wasting the audience's time, and insulting the speaker, than allowing light to leak onto the screen. It destroys detail, falsifies color and stultifies the host. Next worst to light on the screen is light on the eyes, constricting pupils and distracting attention. Exit signs preferably are trans-illuminated black glass with red letters, rather than lighted white cards (consult local authorities). The lectern light is hooded and preferably also the lectern top, to prevent reflection from the white paper. The speaker himself can offend by forgetting to switch off an electric pointer and chasing it around screen, ceiling and audience. (Notes on pointers: in the electric pointer, a press-button requiring constant muscular effort, rather than an on-off switch, may prevent this distraction; in the wooden pointer, keep the tip smooth and clean for the speaker who claws the screen.)

*Received for publication August 8, 1955

Visual [illegible] Satisfactory methods: a blackboard [illegible] the name is painted in white shoe polish, briefly and dimly lit at a point visible without [illegible] standing projection of a slide with gray, not clear, background, to avoid pupil constriction.

PROJECTION SITE

The best spot is the center rear. A long throw necessitates strong illumination but gives a large image, and the position minimizes distractions from projector noises and projectionists' activity. Enclosure, in a separate room or booth, further reduces distraction but is not mandatory for "safety" film. Length of room or limitations of apparatus may necessitate a mid-hall position, sacrificing the best seats i.e., those along the projection axis. Unless projectors can be high, one must accept the wasteful center aisle or else project the audience's heads. Ideally, the projection site provides: space for all projectors and their stands, table for film and slide stacking, dimmer control of room lights, off-on control of darkening curtain motors, and fuse box for all circuits to the room. Electrical connections are *best* with built-in wiring, *next best* are leads dropped from wire-mold on the ceiling, *poorest* are extension cords. Hoods to trap stray light arising in apparatus should be provided, also working-light and signal-light (signal systems: connected to a lamp at the projection site is better than a stationary button, buzzer or mechanical clicker).

Screen

The difference between good and bad screens is less a matter of cost than of selection and protection. Different reflective materials serve different purposes. No reflective material will stand scratching, folding nor the hanging upon it of embroidery exhibits by the Ladies' Aid Society. The research behind modern film; the workmanship in a fine lens; our own study of photography; all are nullified by the wrong surface or by wrinkles, crack and stain. When the illuminated screen appears darker than a clean piece of white paper held on it, it should be cleaned, resurfaced or replaced.

Screen surfaces are matte, beaded, or silver. The beaded screen, of fine glass beads cemented to fabric, is the common roller screen of amateur use. The smaller the bead, the less the unsharpness characteristic of this surface. It has high reflectance within, low reflectance beyond, a narrow viewing angle. Within that angle, sudden change from a full-toned to a thin-image (e.g., slide of type) causes an unpleasant glare which constricts the pupils. Viewed from an angle it reflects light unevenly, being much brighter near the projector axis, while matte screens reflect light more evenly.

The matte surface is a plain flat-white coating on fabric (white rubber sheeting, without further painting, is excellent) or any other surface smooth enough, such as some wall boards (e.g., *Masonite*) or plastered walls. Excellent matte screen surfaces are Kalsomine; or white lead and zinc paint—half and half with a little bluing. It has less reflectance than beads near the projection axis, more than beads on the sides, and should be used wherever possible. Just as in photographic papers, the smooth-to-glossy surface is sharper. Color, either still or cine, records much better than on beads (exception: its low reflectance is inadequate for underexposed color; solution: stronger illumination or beaded screen). If a roller is needed, one might as well buy a commercial matte screen. If the wall is painted, the projectionists should have authority to repaint at will. Matte screens are commercially available in all sizes, beaded in all sizes except for large theaters. Screens in cine theaters usually are matte, and have sound transmitting features.

The silver surface is metal paint, usually aluminum, and has high reflectance within a very narrow audience angle when coated on smooth surfaces. On rougher surfaces its reflecting qualities are between matte and beaded screens. It has no great advantage for medical use but it is necessary for stereoscopic projection with the *Polaroid* system.

A new surface has been announced for theater screens, of woven fiberglass (*Glascreen*). Washable and stretch proof, it is porous enough to be located in front of a loudspeaker. It cannot be rolled. Reflectance characteristics are not yet available but it has been accepted by certain critical users of 16mm films.

The one essential is visibility of the whole image from every seat. The screen must be high enough so that viewers in the rear can see its lower margin. When the floor is flat this means that front seat occupants may have to crane their necks and that the projector stand must be elevated.

Figure 1. Example of projection possibilities in square room. The motorized screen is controlled from projection site and from speakers' stand. A motorized traverse curtain for darkening is controlled in same way. The x-ray viewing boxes and shelves below are located well into corner.

If only motion pictures are shown, a rectangle 4 units wide by 3 high suffices, but the projectible areas of slides vary so in size, shape and axis that still projection necessitates a square screen. Double, "comparative" projection (see above) necessitates a double-square-sized rectangle, preferably without a center dividing line.

Small screens, whatever the surface, usually are supplied on spring rollers with either tripod or wall mounts. Medium and large screens sometimes have heavy tripods but ordinarily are better on the wall, with manual or motor driven rollers. For large screens, as in large halls or for comparative projection, the painted wall is excellent and least expensive. If desired it can be concealed when not in use by curtains or a drop. If a large screen must be movable, a fabric screen with grommets around the edge, stretching-cords and stretcher frame, is used. As in theaters, cloth drapes conceal the cords and stretcher. In theaters, these drapes fill a second function the high angle of projection distorts the image by widening its base and the black drapes "bleed off" overflow image

The screen should provide for an image 1/5 as wide as its distance from the last row of seats: e.g., if the last row is 30-ft. from the screen, the image should be 6-ft. wide A.S.A. recommends a screen image width of 1/5 the distance to last row of seats for slide viewing, while movies permit a smaller image size (1/6) due to movement of the image. Beaded screens may extend this distance to 5½ and 6½ times image width The screen should be larger than the image In a theater, the operator fills the screen with the image, with the help of the adjustable bleeding drapes. This would be pleasing in medical projection, too, and it is practical for cineprojection but not for the variety of projection which medicine demands. With several projectors, or even one convertible

projector using slides of different sizes matted in varying shapes, screen images will differ in shape and size, so the screen should be square and moderately larger than the optimal image width

Throw

As noted previously, the lowest part of the beam should be over the head of any person sitting. If a center aisle must be suffered, the beam should be over the head of a person walking, for doctors always will be paged and have to leave

The rough and ready way of matching image sizes from different projectors (e.g., small-standard, standard, cine) is to string them up and down the center at appropriate distances and so waste the best audience space. It is better to group together all projectors and obtain lenses to equalize, or nearly equalize, images at that throw. If the projectors are to be located approximately at the rear seat line of the audience, it will be found that the focal length lenses (Table I on page 185) will project nearly equal-sized images of correct viewing width for all throws. Opaque projectors, when used at that same distance will screen a larger image, requiring a larger screen size, as suggested above. If the throw is to be longer or shorter than the rear of the seating area, then choose lenses which will screen correct image width for the seating area

Some projectors have a limited choice of lenses. Optical dealers supply a wide variety, but fitting a special lens to a given projector may be bothersome. It is best to determine image size and projector location first, then purchase projectors and lenses for those requirements

Projectors

Optically, a projector is an enlarger. It has a light source, condenser to concentrate and equalize light, material carrier and projection lens. Because of the length of throw, size of image and the fact that the eye, unlike photographic paper, does not register cumulatively, it needs more intense light than an enlarger. Illumination on the screen should give at very least 5 foot-lamberts, measured by American Standards Association methods. This usually necessitates heat filters and/or a motor driven cooling fan. The method of bringing into position the projected material forms the principal difference between projectors. Rheostat control of illumination is advisable to compensate for differing densities in material

The first consideration in selecting a projector is how it fits the room: i.e., image size and intensity at the necessary throw. A good projector is a long-term investment: without trauma from transportation or unaccustomed operators it should serve many years. As a rule, multi-purpose projectors do not fulfill all their purposes equally well. For example, some excellent slide projectors are advertised as microprojectors also, but their microprojection would be far below medical standards. Exceptions are certain satisfactory combinations for opaque material and standard slides and others for filmstrip and 35mm slides. A disadvantage of many convertible projectors is the time needed to convert them. Such different projections as opaque, standard, small standard and micro may be needed in quick sequences or, with comparative projection at the same time.

Budget allowing, the following projectors are desirable:

1. Cine, 16mm
2. Standard 3¼ x 4-in. slide
3. Small standard 35mm (2 in.) slide
4. Micro
5. Episcopic (combination with #2 satisfactory)
6. Filmstrip (combination with #3 satisfactory)
7. Roentgenographic

Well recognized nationally advertised brand names are an assurance of satisfaction in projection equipment as in foods or other commodities. The following points for checking equipment value are suggestions only, but may serve to aid in selection.

Cine Projectors

Only 16mm sound equipment is considered for medical use. Screen light enough for the size of audience and length of throw is first in importance. In general, for audiences which do not extend behind the projector, a 500-watt lamp with direct condenser suffices for a 25 ft. throw; 750-watt for 50 ft; 1000-watt for 75 ft.; carbon arc beyond that.

In medicine a fast lens is more often important in projection than in photography, so a wide aperture and coating are worth

Figure 2. Projection booth in opposite corner of room shown in Figure 1. Platform is as high as possible, with bench top high enough to allow clear passage of doctors in front of lenses: about 7 feet.

while, if the lens is of fine quality. Is the screen image flat? Strong throughout or dark at the corners? Do straight lines curve near the edge?

Can the motor move 2000-ft. reels without overload and consequent flicker, sound-distortion and burning-out?

Controls, on sound machines, should furnish governor-controlled speeds of 24 and (for silent) 16 frames/sec., and reverse, all without belt change.

Other features to consider are: Automatic prevention of film break from loss of loop; tilting and elevating; pilot light; separate lamp and motor switches; ease of threading; ease of lamp change; interchangeable lamps of various wattages; lamp rheostat; radio interference suppressor; portability (if desired).

Sound systems can be discussed only briefly. Instead of accepting advertising as proof, ask for demonstrations in your own hall and test with a sound track having a full range of frequencies. (Obtainable from Society of Motion Picture & Television Engineers). Speaker and amplifier should be balanced with each other. In general, the amplifier should deliver volume enough for the largest audience and have bass and treble boosters to compensate for acoustical peculiarities of the room.

Final results depend not only on the power, range and balance of units but also on the baffling of the speaker, its mount, its location and the room's acoustics.

Projectors for Standard Slides

If designed for that use alone, usually are satisfactory. Multipurpose projectors often are not, with the exception (Episcope) noted above. The lens is even more important in still than in cine projectors (q.v.) because there is no motion to conceal optical faults. Every lens should completely and satisfactorily cover the largest possibe mat opening. Condenser systems are not invariably good. For long screening times or powerful lamps, both heat filter and blower are advisable. Rheostat control of blowers reduces wear and noise. Lenses of various focal lengths are available for most standard projectors. The ordinary wattage is 500, although American Optical and GoldE have 750 and 1000 watt models.

Small Standard Projectors

More amateurs than professionals use 35mm but most professionals use it to some extent and, even if one never uses it himself, the most distinguished of his visiting speakers is likely to arrive armed with nothing else. The 35mm projector has become a "must".

It is possible to project 2-in. slides in a standard-slide projector with a special masking carrier, but it is not possible to do so satisfactorily without changing or focusing the condenser to avoid losing half the light; and changing the lens to avoid a half-size image. With present equipment, changeover is too slow for the speaker who staggers both sizes of slide.

The comments above about lens, condenser and cooling system apply equally to 35mm projectors. For very large halls, 1000 watts are needed.

For the short throw required by classrooms and seminars having audiences up to 100, 150-300 watt projectors are satisfactory. They are handy, too, for barnstorming, editing and slide selection.

Microprojection

Compared with the projection of photomicrographs, microprojection has advantages and disadvantages. It saves the time, delay and expense of photomicrographic slides. There is no color problem. The speaker can

range all over a section, showing multiple fields at successive magnifications. Even with present microprojection, screen images can not be both large enough and bright enough at high magnification for a large audience. In brief, microprojection seems better than projecting photomicrographs for the class or seminar, inferior for the society meeting. Present light sources include incandescent, carbon arc, and mercury arc lamps. The new mercury arc lamp is heat-free (water cooled), flicker-free and is the most intense source in commercially available microprojectors. The writer knows of only one mercury arc microprojector, the Scopicon. This can project satisfactorily for small groups, all the magnification an optical microscope can furnish, to over 1000X.

Episcopic Projectors

Opaque material, if flat or nearly so, can be projected satisfactorily. One may project for example, the surface or cut surface of a fresh specimen, a page of an original article, a multicolored diagram — sometimes made on the pot. Reflective projection is much less brilliant than transilluminative. It is limited to small flat objects, but saves the expense of slides. Fan suction, to hold sheets of paper is desirable.

Filmstrip Projectors

Until the fine possibilities for filmstrip in medicine have been explored further than at present, it may suffice to install one of the combination projectors, which handle both 2-in. slides and filmstrip.

Roentgenograph Projectors

Eight-inch circles of a roentgenograph (or other translucent material) may be projected by the "Overhead" machines. With a 30-ft. throw the special Dillon-Murphy Roentgenogram projector will give a satisfactory 6 x 8-ft. image of a 14 x 17-in. film. Roentgenograph projectors, although new and expensive, obviate the delay and expense of slides or the effort wasted by looking at films held against a distant viewing box.

Special Projectors

Overhead Overhead projectors send the light beam vertically upward, then, by front-surface mirror, across to the screen. They project slides and other translucent material up to 7-8 in. square. These projectors are located in front of the audience about 10 ft. from the screen, and the projected material is horizontal and accessible to the lecturer during projection. With practice, skillful "chalk talks" with wax pencil drawings on acetate sheets or cleared film are made feasible. Disadvantages include the need for tilting of the screen to intercept the beam squarely; blocking of some best seats by the front position of projector, mirror, and speaker himself. Overhead projectors spill light to ceilings, which may in some cases reduce effectiveness beyond usefulness.

Automatic These magazine projectors are useful in exhibits, at meetings, and at home to keep current illustrations before the staff. Those which also have optional control by push button on an extension lead, are useful at meetings where the speaker does not wish to entrust his slides to an inexperienced projectionist. Much care is required to keep these machines in operating condition.

Stereo These require some increase in wattage (to overcome light loss from filters) aluminum screen and special viewing glasses. Very doubtful value for average use.

Methods and Technique

Comparative Projection Before-and-after pictures; the facies and the clinical chart; the roentgenograph and the lesion; gross and microscopic pathology—all teach more if seen together. If lenses are chosen for images of about the same size and if there is a full width screen area for *each* image, two or more projectors can be used to present the material comparatively. A matte white painted wall is preferable to two separate screens. It allows more leeway in image-size and facilitates centralizing of one image during ordinary projection. A simple signal system should be arranged in advance, which will permit this more difficult projection to run smoothly.

Technique

Projection is not a learned occupation and the projectionist rarely is praised. He is blamed, however, and not always unjustly. He can effectively spoil a good job of illustration, to say nothing of the speaker's self-control and the audience's time. The cine figure transposed at the umbilicus by the frame, and the slide tried three ways before it becomes legible are distracting in the extreme. Audiences lag in returning from the ridiculous. The projectionist should be assured by the lecturer that his movie reels are

Table 1.

With projectors located at rear of seating area, these lenses will project approximately correct image sizes at all throws.

Projector Types	Lenses	Projection throw (in feet)	Image Widths (in feet)	Image Widths recommended (in feet)
Small	6½ in	50	10.2	10.0
Standard		30	6.1	6.0
(35mm)		20	4.0	4.0
Standard	1[3] in.	50	9.5	10.0
(3¼ x 4 in.)		30	5.7	6.0
		20	3.7	4.0
Cine	2 in	50	9.3	10.0
(16mm)		30	5.5	6.0
		20	3.7	4.0

correctly wound, slides are in order, correctly oriented and thumb spotted. The speaker should be briefed on the pointer and signal system. The projectionist should be made aware of any slide to be repeated, (a duplicate is preferable.) and any other special instructions, such as alternating standard and small-standard slides. Rehearsal is excellent but rarely practical. However, the projectionist often may find a paper on the medical subject to be presented, which will aid in his projection technic. It is the speaker's responsibility to call for the proper slide at the proper time, but he often errs, especially when he does not or cannot watch the screen. Some knowledge of the subject by the projectionist may prevent delay.

The projectionist will thoroughly know the seating, exits, lighting and darkening conditions of the room. He will know all his projectors well enough for quick repairs and be prepared to replace bulbs, belts, carbons and fuses; to cut, splice or quick-hitch film.

The projectionist will listen intently to the speaker even when the audience sleeps; be prepared to change slides promptly but not prematurely; being careful to watch screen, frame, focus and loops. It usually is best to have the next film out of the can and slides stacked rather than boxed. The films and slides to be used should be stacked in order and apart from the used.

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Training Medical Photographers*

WENDY HALL

British Information Services
50 Rockefeller Plaza, New York 20, N.Y.

MEDICAL photography has assumed increasing importance in recent years in the treatment of disease, in the teaching of medicine and surgery, and in research. To train students in this specialized branch of photography, the London School of Medical Photography was established in 1952. It is one of the first schools in the world to offer a comprehensive course of training in medical photography. It is also unique in its lack of premises, or of teaching staff in the sense usually associated with a school.

Before the London School was set up, medical photographers were generally trained in the photographic department of a hospital, prior to taking the qualifying examination of the Institute of British Photographers, which is not itself a teaching body.

Individual Enterprises

It had become clear that no single hospital could give the student the breadth of experience needed either to get through the examination, or to qualify himself for a wide range of posts. Norman K. Harrison, head of the Department of Medical Photography at St. Bartholomew's Hospital, London, and now secretary of the school, enlisted the aid of other medical photographers and they drew up a curriculum which would give students the opportunity of studying several different types of medical photography, by working for short periods at eight different hospitals and medical institutes. This was agreed by the eight bodies concerned, and by the heads of the respective departments of photography, who now form the council of the school.

The school, as it now exists, is an interesting example of individual enterprise within a public framework. The funds necessary to launch it were provided by the eight heads of departments of photography as private individuals. The school does not come under the jurisdiction either of the Ministry of Health or of the University of London, although it serves the ends of both. It is the creation of eight men who believed it to be not only necessary, but valuable.

The course lasts four terms, and no student is admitted unless he has passed the intermediate examination of the Institute of British Photographers, since the School of Medical Photography does not teach photography as such but only the application of photographic techniques to medical subjects. All students spend their first month in the Department of Medical Photography at St. Bartholomew's Hospital under Mr. Harrison, and return to him from time to time for revision and further training.

Practical Training

The time is then divided between St. Bartholomew's, Guy's, and St. Mary's, all general hospitals; the Middlesex, a general hospital where students are able to specialize in color photography; the Institute of Opthalmology, the Hospital for Sick Children, the Royal National Orthopaedic Hospital and the Imperial Cancer Research Fund Department at the Royal College of Surgeons. The length of time spent at each varies. Six weeks at the Institute of Opthalmology is thought to give sufficient experience of eye photography; but twelve weeks at the Hospital for Sick Children is needed to train students in photographing a wide range of child subjects.

At each hospital or institute, students are attached to the department of medical photography, and are trained by its head. Training is essentially practical, as students take part in the work of the department, and the time which the head gives to instructing them is compensated in part by the contribution they can themselves make, since photography departments are generally overloaded with work.

Given the fact that there are no premises, nor teachers in a formal sense, it is impossible for the school to take on a large number of pupils. Since the courses were launched, numbers have ranged from one to two per session. Six is thought to be the maximum manageable number.

Specialized Courses

The school does, however, arrange shorter and specialized courses, lasting from four to eight weeks, for qualified medical photographers who wish to gain additional experience

*Received for publication August 19, 1955.

Medical photography is assuming increasing importance in the treatment of disease. In this picture taken in a London hospital, a patient's legs are being photographed as part of a pictorial record of his progress.

Photographing an operation at St. Bartholomew's Hospital, London.

in a single branch of the work. If, for instance, an Indian wished to get specialized training in the photography of skin diseases, it would be arranged for him to spend a period at St. Mary's Hospital, where all students of the school receive their training in this aspect of medical photography. Already the school has had one student from Ceylon, and has received many inquiries from other parts of the Commonwealth.

The contribution made by these photographers to medical science passes more or less unnoticed by the lay public. Only those patients who have suffered from diseases with markedly visible symptoms know how much doctors have been helped by the possession of a permanent and absolutely accurate record of their progress. Some patients may be photographed every three months for as long as six or seven years.

In the teaching of medicine and surgery the value of the use of lantern slides, cine films and film strips which illustrate photographically actual cases and operations is obvious, and in research the photographic record, whether of a germ culture or a patient, provides that unfailing memory which leaves no doubt in the mind of the research scientist or those who take his work on from him.

BOOK REVIEWS

SENSITOMETRY, *L. Lobel and M. Dubois, The Focal Press (London and New York), 260 pages, illustrated, (1955), bound, $5.00. (Distributed in U.S.A. by Amphoto, 33 W. 60th Street, New York 23, N.Y.)*

Here is a book certainly worth $5.00 or even more — but its distribution in America will be limited by the mere fact that it *does* cost $5.00. That's bad, because a sensible treatment on the subject of sensitometry at a popular level, which this book is, should have the greatest possible readership among photographers and photo-technicians. The price for the book in England is $3.50. Why it should cost $5.00 in the U.S.A. will be a mystery to anyone who buys British publications at the regular exchange rate, since the difference normally is nothing more than about 15 cents for postage when books are ordered from abroad.

However, even $10.00 would be a cheap price for the amount of information conveyed by Lobel and Dubois, especially when one learns from the "introduction" that Dr. W. F. Berg had a hand in the translation from French to English. The book covers all the usual topics of sensitomery, i.e., basic definitions, instruments for sensitometric exposure and densitometry, curve plotting, evaluation of results, etc., but very little is said about the *reasons* why sensitometric practice is what it is. Berg's book on "Exposure" (also published by Focal Press) introduces more fundamental ideas on this aspect of the subject.

As stated on the book's jacket, sensitometry today is not confined to measuring emulsion speeds, but covers practically every field of photographic investigation. A knowledge of the subject is invaluable in acquiring a real understanding of the photographic process, and is indispensable for controlling processes in laboratory practice. This book will serve well for those who want to have a basic background in sensitometry, especially those who have considered higher mathematics a prerequisite for learning the fundamentals of the subject.

ASTRONOMICAL PHOTOELECTRIC PHOTOMETRY, *Edited by Frank Bradshaw Wood, American Association for the Advancement of Science, Washington, D.C., (1953), 147 pages, 6 in. x 9 in., illustrated, cloth bound, $3.75.*

Nine authors collaborated with the editor in preparing the 8 chapters of this book, which is based on a symposium at the AAAS meeting in Philadelphia in 1951. The chapter titles are as follows: The Use of Direct-Current Techniques in Photoelectric Photometry of Stars; Alternating-Current Techniques and Sources of Error; The Use of Pulse-Counting Techniques; Photoelectric Installation of the Observatoire de Haute Provence (2 chapters by different authors); The Performance of Two Pulse-Counting Stellar Photometers; On the Use of Servomechanisms in Photoelectric Photometry of Stars; Limits of Sensitivity and Precision Attainable by Photoelectric Methods; Critical Summary and Comparison of Various Techniques.

Anyone who has need for applying photoelectric methods for light measurement will find a wealth of generally applicable data in this book even though the discussions are directed toward the astronomical field.

Journal of the University Film Producers Association Special Glossary Issue.

Over 400 terms used in the production of 16mm non-theatrical motion pictures are defined in the Summer, 1955, issue of the University Film Producers Association's Journal. Terms range from Aberration to Zoom Lens through definitions of such words as Baby, Bloop, Dead, Flutter, Pacing, Scrim, Tail, Wild and Wow. The rapidly increasing number of people involved in 16mm production makes it mandatory to adopt a uniform vocabulary in intercommunication if misunderstandings are to be avoided. This list was prepared primarily for members of the U. F. P. A. but nevertheless will be of great value to all who come in contact with 16mm films whether in production or exhibition. Price 70 cents per copy; 40 cents in lots of 50.

New Products

JULIN SURGICAL NOW COMMERCIALLY AVAILABLE

The Waters Corporation, Rochester, Minn., has introduced its Aseptic Automatic Surgical Camera (Model SC-10) which is a modification of the camera described by Leonard [illegible] in the November, 1950 number of J.P.B.A.

The essential part of the camera is a housing that can be sterilized in an autoclave. The housing is wrapped in a sheet and sterilized with the [illegible] surgical supplies. When pictures are to be made, the housing is unwrapped, the sterile nurse opens the housing cover while another person carefully inserts the camera. The nurse [illegible] only.

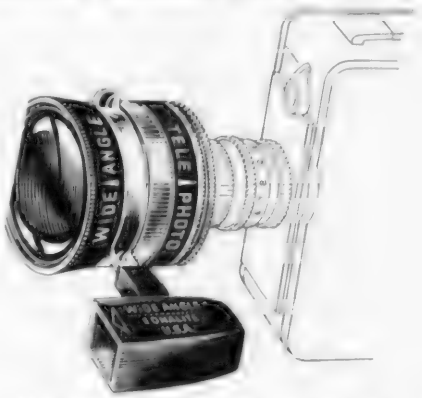
The housing is a box made of anodized aluminum and stainless steel having a hinged cover which is lifted [illegible] front. In the flash bulb window is a round [illegible] optical glass in front of the lens. The [illegible] the lens from any stray light. The housing has two handles on which are the controls for focusing and for exposing.

For focusing purposes, two small spotlights are attached to opposite sides of the camera at such angles that their beams close in front of the lens at the correct focal distance. The [illegible] focusing lens produces two spots of bright light that can easily be seen in the center of the field. When ready for use, the camera is brought near the subject until the two [illegible] are superimposed in the center of the field indicating the correct focal distance. Then the exposure is made by activating the plunger on the [illegible] exposure, both plungers must be depressed to [illegible].

A small electric motor powered by three flash light batteries advances the film automatically after the exposure is made. The [illegible] indicates when the batteries need to be replaced. [illegible] which the exposure counter is visible.

When the [illegible] following actions occur: the flash lamp is fired and the shutter opens and closes following which the film, the exposure counter, and the firing contacts advance to the next position. In the event a series of exposures can be made before it is necessary to reload the camera. The [illegible] pictures of exacting detail eliminating the necessity for artistic or commercial photographers for illustrations in medical text. It provides thereby a practical means to illustrate critical steps in complicated operations.

EDNALITE REVERSIBLE DUAL-LENS



[illegible] Peekskill, New York has just announced a new movie camera lens. Called the "Dual-Lens" this new lens enables an 8mm movie camera [illegible] position, the Dual-Lens enables the user to [illegible] over, telephoto movies can be taken. No light compensation is required, and the lens is color corrected, and has hardcoated optics. Available for almost all 8mm movie cameras [illegible] viewfinder is available for cameras not [illegible].

HASSELBLAD MICROSCOPE ADAPTER

A new adapter, designed to fit the [illegible] x 2¼" Reflex Camera, is manufactured by Willoughbys-Watson, American distributors. The mounted adapter is tipped with a [illegible] which fastens to the tube of the microscope. The Hasselblad Microscope Adapter sells for [illegible] Willoughbys-Watson, 110 W. 32nd St., New York 1, N.Y.

ECONOMY GLASSBINDERS

Filmosto A (for Airequipt) is the name of the new [illegible] glassbinder, built to fit into the automatic Airequipt slide hanger. Two connected sheets of extra thin, optical precleaned glass with predecision-ground edges form the actual binder which [illegible] 1) Peel off protective foil which covers the adhesive, inside the glassbinder. 2.) Insert transparency into the built-in mask of the glassbinder. 3.) Press self-sealing glassbinder firmly together. Mounted within a [illegible] the glassbinders can be easily inserted to the metal pockets of the Airequipt slide hanger. They give the transparencies [illegible] permanent protection against wear, dust and heat. Box of 20, $1.95. Box of 100, $8.9[illegible] Distributors: Karl Heitz, Inc., 480 Lexington Avenue, New York 17, N.Y.

CIRCULAR LIGHT UNITS

[illegible] manufacturer of the [illegible] types of Circular Light Units that fit around the lens of a camera. Since the light comes from all sides of the lens, it results in a [illegible] type of light. These Circular Light Units are particularly suitable for taking pictures of cavities, such as the mouth, and for [illegible] where the [illegible] elimination of shadows is desired.

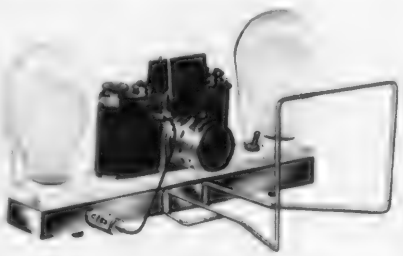
Model AL-417 is designed for operation [illegible] and equipment, such as the Graphlex Model 4x5. The unit measures [illegible] and its price is $45.00. Model BL-411 is designed to work with [illegible] and the Auto-Graphic. The unit measures [illegible] and sells for $42.50.

Each of these light units has provisions for the use of cable and shutter to a Series VI Adapter Ring. The Adapter Ring then slips over the lens of the camera. A step-up or step-down ring is required for [illegible]

DIAFIX 35MM STRIP PRINTER

[illegible] Ave., Chicago 4, Ill., is marketing a [illegible] that prints [illegible] perforated paper and film materials. Positive prints or transparencies can be produced by making contact exposures [illegible] using an enlarger as the light [illegible]

NEW MAYFAIR LITE UNIT



The Mayfair Lite Unit has been redesigned to comply with suggestions received from doctors and medical photographers. The [illegible] are: quicker mounting; sturdier focusing frames; longer travel synchronizer; adjustable pushbutton control. The price of the new model remains the same as the earlier model, namely, $19.95. Further details are available from Mayfair Manufacturing Co., 96-13 Grand Street, Brooklyn, [illegible] N.Y.

Your Association

A section of the Journal devoted to official announcements, chapter events, and other matters of historical significance to the Association.

CHAPTER NEWS

L. B. Brown, Chairman, Chapters Committee

Boston: Four members from Boston attended the Annual Meeting in Milwaukee. A report was given to the "stay at homes" at the Harvard School of Dental Medicine in September. There was a short business meeting and election of officers. Laurence B. Brown and Barbara Jacobs were re-elected Chairman and Secretary-Treasurer, respectively. After a cider break Ferd Harding showed "Marine Kodachromes", enjoyed by all.

Southern California: On September 22 there was a Build It Yourself Demonstration" by Lloyd Matlovsky. A shadowless reflector, an A-C speedlight, and a sensitive trigger circuit were the highlights.

On October 20, Mr. Ed Schaeffer and Mr. Roger Cecconi of Eastman Kodak answered questions on the new Kodak color print materials, Type C and Type R. Mr. E. N. Bolton showed examples of flower photography at its best.

Chicago: The September meeting was at the University of Illinois College of Medicine. Miss Helanie Levin, head of film library of A.D.A., talked on "Dental Film Production and Use". There was also a report on the Milwaukee Annual Meeting.

In October the State Microscopical Society of Illinois invited BPA members to a lecture at the University of Illinois College of Medicine on "Low Power Stereophotomicrographs in Color", by Lester Shenberger, Purdue University, and Wolfgang Zieler, E. H. Kessel Co.

The Chicago Chapter is to be complimented on an attractive flyer recently put out as part of a membership drive. Other chapters should follow their example.

Upper Midwest: Verlin Yamamoto had a fine display at the Milwaukee Meeting called "Effective Lantern Slides for the Oral Paper". We hope this can be circulated among chapters and displayed at local medical society meetings. Contact Verlin Yamamoto or Laurence B. Brown if interested.

New York: First meeting of season was held at Cornell University Medical College, September 22. There was a business session and a report on the Annual Meeting by Mr. Percy Brooks.

In October Mr. Paul Matthews spoke on "A System of Exposure Determination that Will Apply to All Types of Lighting". This was a method to minimize under- and over-exposure.

Prairie: The September meeting was at Winter V.A. Hospital, Topeka. Mr. McGrew reported on the Annual Meeting. Chapter meetings will be monthly and will center around two themes: the development of the best technical skills and guidance of the medical staff in planning and utilizing illustration material.

In October the group met at K. U. Medical Center and went to Elko Photo Products Co. for color processing demonstration.

Texas: The Texas Chapter changed its name to Houston Chapter since most members are in that area. Money has been put aside to form a Dallas Chapter when members in that area are ready to branch out on their own.

First meeting of season was held in September at Baylor University with a full day's program. The Department of Visual Education held open house and later there were papers and discussions. Dr. Olson, Dean of Baylor University College of Medicine presented a film on the Nation's first realistic test of a mobile civilian medical disaster unit called "Operation Mercy". The Ortho-Illuminator, W. H. Curtin Co., was demonstrated and papers by R. M. Christopher and R. D. MacIntyre were "A Simple Exposure Calibration for Photomicrographs" and "Use of Industrial X-ray Film for Halftone Slides".

The officers of the Houston Chapter are:

Chairman:	Wynne Eastman
Vice-Chairman:	James H. Law
Secretary:	Billye Bailey
Treasurer:	Richard Matthias

New Chapters: The Chapters Committee is pleased to announce a new chapter being formed in Montreal, Canada, called the St. Lawrence Valley Chapter, headed by Charlie Hodge and Jacques Renaud. We soon hope to welcome them as the 16th Chapter of BPA.

LOUIS SCHMIDT AWARD 1955

The man who is to be awarded the Louis Schmidt Award this year started his professional career in 1928, as a portrait photographer in Chicago. In 1930 he became associated with the photographic department at the Mayo Clinic. Some six years later he became head of the photographic department at the Wayne County General Hospital, Eloise, Michigan. Here he pioneered in color endoscopic photography, working in collaboration with Dr. T. N. Horan. He also devised a variable light X-Ray copying stand and other equipment. With the advent of World War II he became Commanding Officer, 1st Medical Detachment, Museum and Medical Arts Service and was assigned the 20th General Hospital, Assam, India. As this was the first group to go out in the field, he and his command more or less served as a guinea pig for future MAMAS. Since 1946 he has been Chief, Medical Illustration Division, Veterans Administration, stationed in Washington. From the very first of his membership in the Biological Photographic Association he has been active in it. He has served as chairman or member of many committees. He became a director in 1940 and was re-elected in 1942. He resigned as a director in 1943 when he went overseas. He has again elected a director in 1946, was Vice President from September 1949 to December 1951, and President in 1952 and 1953. One of his accomplishments has been the revision of our Constitution and By-Laws, begun while he was President and recently finished.

He has worked closely with the Certification and Educational Committee since closing his work as Chairman of the Standards Committee. He has probably done more than any other single individual to raise our professional standards and give us our due recognition in the medical field. I could go on for a long time telling you of what he has done in biophotography, which term he first used to describe medical photography in 1947, and which I hope will be universally used in the future. He has done so many things so well, that I am going to stop here and ask C. Graham Eddy to step forward.

NEW B.P.A. MEMBERS

(July through Sept. 1955)

Richard E. Amos, *Columbus, Ohio*
Mervil A. Anthony, *Dayton, Ohio*
Donald E. Bechard, *Chicago Heights, Ill.*
Theodore L. Bell, *San Sebastian, Puerto Rico*
Richard Boyajian, *Chicago, Ill.*
Perry Burgess, Jr., *Geneva-on-the-Lake, Ohio*
Lt. Thomas H. Case, *Toledo, Ohio*
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Francis DeRosa, *Rochester, N.Y.*
Ralph A. Deterling, Jr., M.D., *New York, N.Y.*
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Samuel Elder, *London, Canada*
Frank J. Eytalis, *Chicago, Ill.*
Leonard Z. Goldstein, M.D., *Philadelphia, Pa.*
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John W. Gunn, Jr., *Verdun, Canada*
Harold E. Hambrick, *Slidell, La.*
Lcdr. John D. Krafchuk, M.D., *Vallejo, Calif.*
Kresimir Jurisa, *Barquisimeto, Venezuela*
Frank B. Manarchy, *Rockford, Ill.*
Reeder McKandles, *Dayton, Ohio*
Howard E. McNamara, *Sioux Falls, S.D.*
John W. Merrimen, *Halifax, Canada*
June Morris, *Detroit, Mich.*
Thomas C. Morris, *Metairie, La.*
Arnold K. Myrabo, M.D., *Sioux Falls, S.D.*
Leonard J. Pollock, *Saskatoon, Canada*
Sister Mary Scholastica, *Sioux Falls, S.D.*
Allen J. Silver, M.D., *Encino, Calif.*
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Prof. Arthur R. Spurr, *Davis, Calif.*
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VERLIN Y. YAMAMOTO
H. WOLFGANG ZIELER
STELLA ZIMMER

FELLOWSHIP PROCEDURE

Members may propose for Fellowship in the BPA other members whom they consider worthy of recognition. To be eligible for Fellowship a candidate must have been a member of the Association for five consecutive years and must possess one or more of the following qualifications:

Superior craftsmanship in still or motion picture photography of biological subjects.

Ability in photographic research in new methods or materials.

(These require submission of evidence.)

Meritorious contributions to biological photography overall through sustained organizational work.

Two sponsors are required. The sponsors should be well acquainted with the candidate's work and ready to furnish the Board with details of his experience and achievements. Those who wish to sponsor a member whom they believe to be eligible should request a Fellowship Application form from the Secretary of the Fellowship Committee: Mrs. Maria Ikenberg, University of Illinois, 904 W. Adams Street, Chicago 7, Illinois.

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